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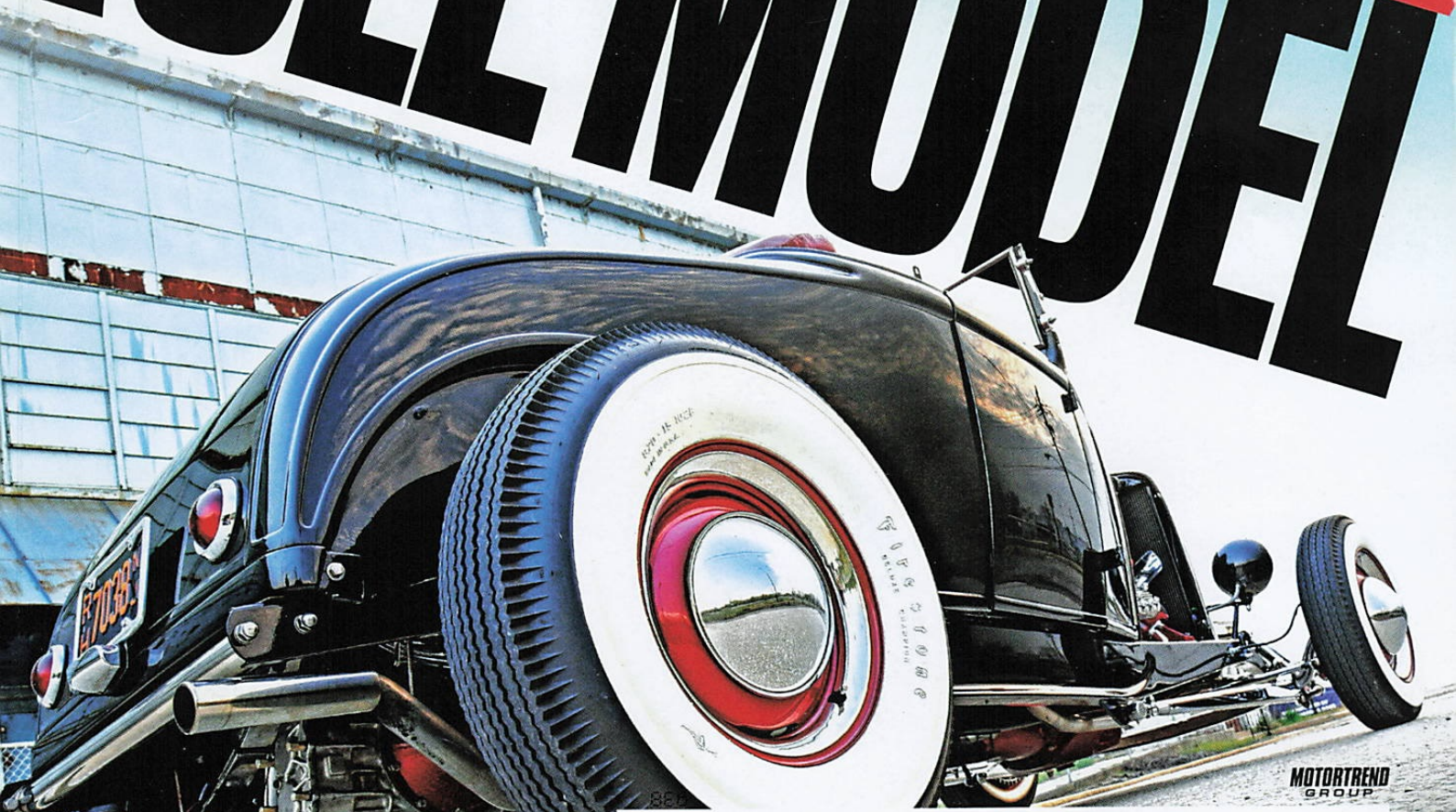

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03 21 Contents

HOTROD.COM EVERYDAY

06
Starting Line
with John McGann

08
Hot Rod
20, 40, and 60 Years Ago

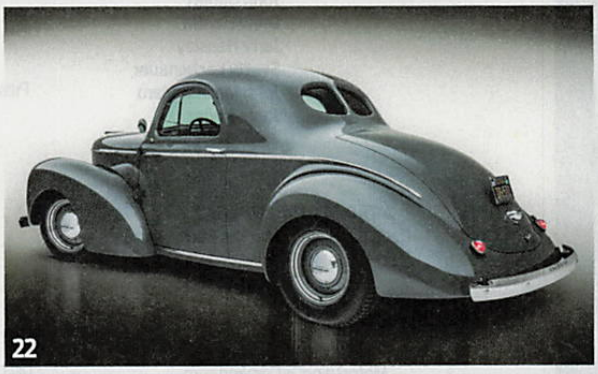
10
Where It All Began:
Dan Gurney's
1961 Chevrolet Impala SS

12
Nick Jr's '31 Model A Roadster
Inspired by Dad's
'31 Model A Coupe

22
Sleeper Willys
LS3-Powered
'41 Willys Coupe

26
Labor of Love
Restored 1970
Chevy Camaro Z28

32
Jeff Cleary's 1970 Nova
Budget Build Turns Pro Touring



40
Week 2 Wicked
We Build a '67 Chevy Nova
Pro Touring in a Week

48
Finishing Touches
Installing New Pedals

54
Do You Need Bigger Brakes
Upgrading a 1974 Duster

60
Rust Repair
'68 B-Body Taillight Panel

66
Fail-Safe LS Rocker Arms
Needle Bearing Upgrade

68
Quick Tech
With Marlan Davis

70
Reader's Tech Q &A

82
In the Words
of Freiburger...

ON THE COVER:
1931 Ford build from family tradition.
Photo by **Scotty Lachenauer**

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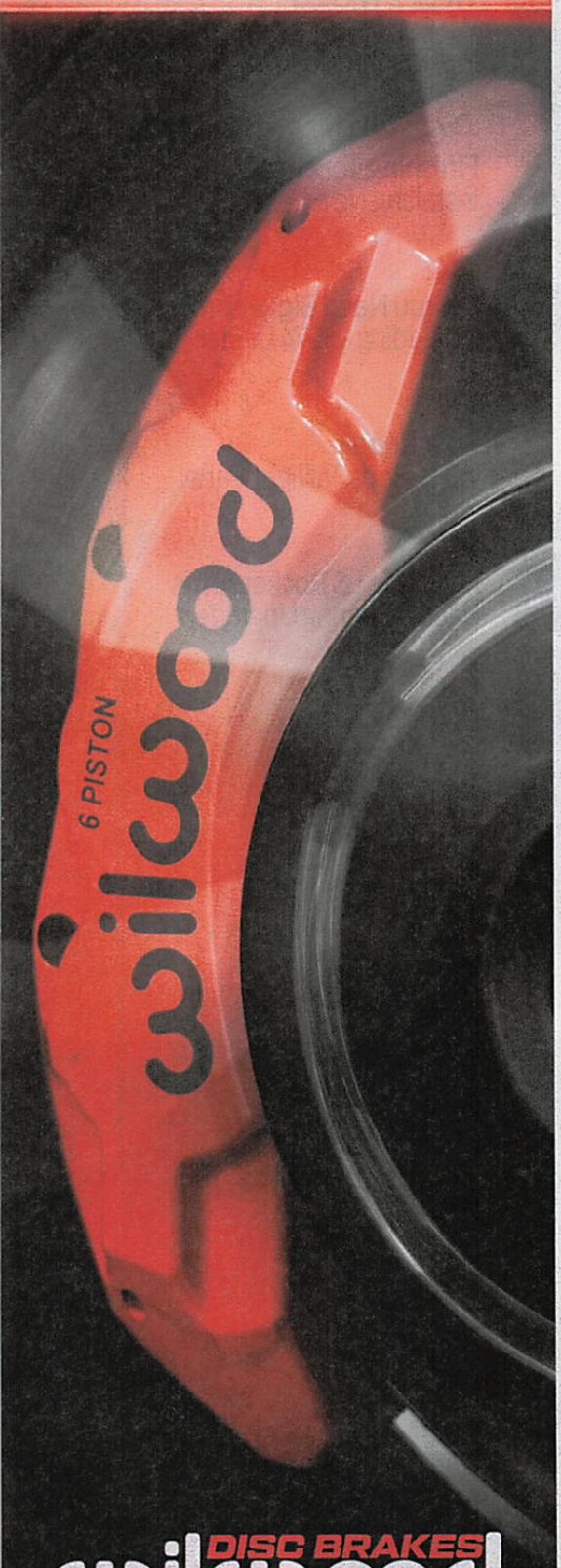

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A Clean Sweep

By John McGann

Editor-in-Chief
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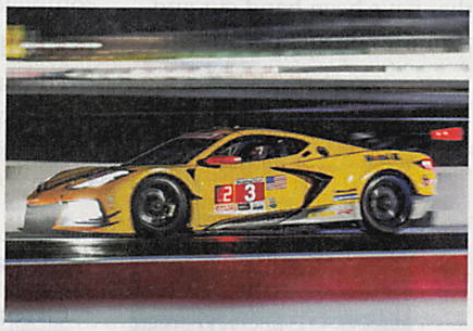
After securing both the drivers' and team Championships at Laguna Seca, Corvette Racing finally claimed the Manufacturer's Championship for Chevrolet in the IMSA WeatherTech Sports Car Championship series at the 12 Hours of Sebring, the last race of the season. The Corvette C8.R has been a dominant force in the GT Le Mans Class (GTLM) in 2020, claiming six victories, seven pole positions, and the fastest race lap at five venues.

Chevrolet fields two C8.R race cars in GTLM, the No. 3 car, driven by Antonio Garcia and Jordan Taylor, and the No. 4 car, driven by Oliver Gavin and Tommy Milner. Nicky Catsburg and Marcel Fässler join the No. 3 and 4 teams, respectively, as extra drivers in the long endurance races. With their second-place finish at the Hyundai Monterey Sports Car Championship race at Laguna Seca, the penultimate race of the season, Garcia and Taylor secured both the drivers' championship for themselves and the team championship for Corvette Racing. At Sebring, Garcia put the No. 3 Corvette C8.R on the pole position with a lap-record time for the GTLM class, and with both cars taking the green flag to start the 12-hour race, Corvette Racing earned the manufacturer's championship for Chevrolet, its 13th in IMSA GT competition since 2001.



At Sebring, both cars experienced suspension problems late in the race that put them in the back of the GTLM class, which is unfortunate because the No. 3 car had been running in first or second place for most of the race prior to the incident. Although the team had both cars repaired relatively quickly, they returned to the race several laps behind their class competitors.

Sebring was also the last race for Gavin as a full-time driver for the Corvette Racing team. Prior to the start of the race at Laguna Seca, Gavin announced he would be stepping down from full-time driving duties at the end of the season, his 19th. Corvette Racing recently announced that Nick Tandy would replace Gavin in the No. 4 car, with Alexander Sims as backup driver in the long enduro races. Tandy had been a rival on track in 2020 as one of the drivers for the factory Porsche team.

In all, the 2020 GTLM season is considered to be an overwhelming success for the C8.R car and is only the second time a first-year Corvette race car has won an IMSA championship. The C6.R was the first to claim that accomplishment in 2005. I am anxiously awaiting the 2021 season, which begins with the Roar Before the 24 on January 22-24, immediately followed by the Rolex 24 Hours At Daytona on January 30-31.

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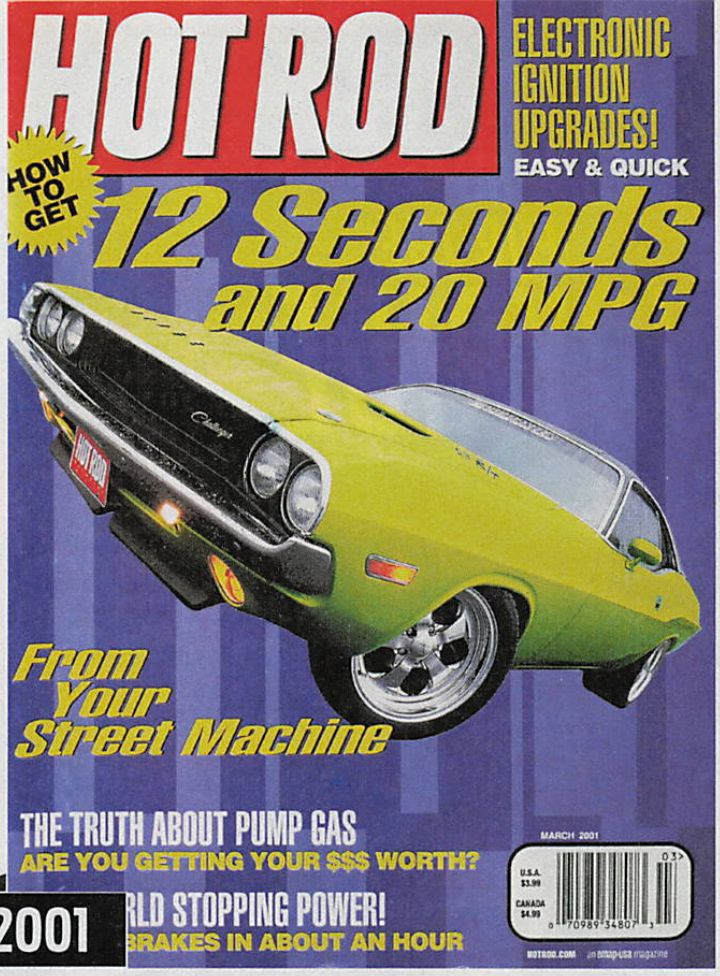
The HOT ROD Archives

20 Years Ago

March 2001: 136 pages, $3.99

Twelve seconds and 20 mpg is a pretty compelling headline, and we suspect this issue sold pretty well because of it. The Sub Lime 1970 Challenger was a worthy car, too. Photographed in the rain while on the previous year's Power Tour, a dreary setting is likely the reason why the car was clipped out and dropped on a high-tech-looking bar graph background, presumably to hint at the tech-heavy feature within. The Challenger was part of a compilation of cars that all ran in the 12s at the dragstrip but were thrifty on mpgs at the same time. The six-page feature contained an interesting mix of miserly machines: a '66 Nova with a Buick Grand National engine, a '75 Vega with a ZZ430 small-block crate engine, an '84 Mustang SVO with a Turbonetics turbocharger in place of the stock unit, and an '89 Civic (yes, you read that right!) with a supercharger on the 1.5L SOHC Honda engine that was good for 487 hp. Our favorite of the group is the Challenger, which had been built with a Magnum 360 engine from a '96 Ram pickup augmented with a Vortech V-1 S-Trim supercharger.



40 Years Ago

March 1981: 136 pages, $1.50

Let's all just pause for a moment and give thanks to whatever higher being you believe in that our current automotive landscape isn't the performance wasteland of the early '80s. Otherwise we'd be writing about today's equivalent to the 1981 Ford EXP. Ironically, today's equivalent would outperform the best sports car of '81, but that's a different matter. Nonetheless, when life gives you lemons, you put an EXP on the cover, along with its Mercury stablemate, the LN7, then you damn them with faint praise with lines like, "Of course, the lean calibration of the induction system for emissions doesn't help, but all new cars are faced with that problem." My heart goes out to those guys. It wasn't all doom and gloom in this issue, however. Former GM engineer and suspension expert Herb Adams penned a stellar piece on improving the handling of a second generation F-car, and Camaro and Firebird owners would do themselves a favor by tracking down a copy of this issue on eBay. It's that good. Elsewhere in the issue, Tech Editor Marlan Davis wrote a comprehensive guide to hopping up Ford's 2.3L Lima four-cylinder engine found in the Pinto, and Cam Benty wrote a cool feature on Ted Dzus' wild Pro Gas Chevette race car.

60 Years Ago

March 1961: 108 pages, 35¢

There was a ton of good stuff in the March 1961 issue, and it spanned a dizzying array of subject matter, from hardcore tech, to sand dune racing, to karting, and engine durability testing. This was an ambitious issue, for sure. In our opinion, the starring article of the issue was on the Dual Lobe Cam, a notion investigated by veteran cam grinder, Bus Schaller. He had been experimenting with the technology on motorcycles prior to acquiring the equipment large enough to grind automotive cams. Though it's difficult to summarize here, the concept was to machine a camshaft that turned at a quarter of the speed of the crankshaft, instead of half the speed of the crank, like all automotive engines then (and now) do, and the benefits were that the lifters were able to follow the lobes of the slower-turning camshaft much more precisely. Because of this, valve float and valvetrain noise were greatly reduced and the engine ran more efficiently, and therefore made more power. He demonstrated the effectiveness of his concept in a small-block Chevy powered dragster. Did the technology ever take hold? Not in our automotive world, but advances in lifter and valvespring technology over the years have likely addressed the problems Schaller set out to eliminate.

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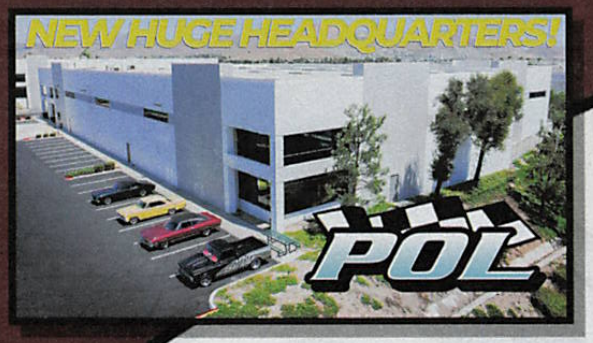

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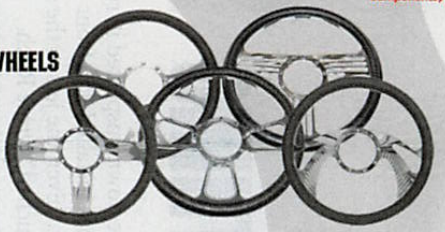

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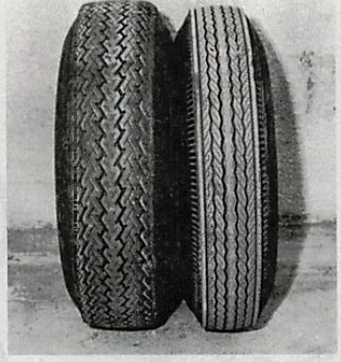


DAN GURNEY'S 1961 IMPALA WAS A WOLF IN SHEEP'S CLOTHING

This 1961 Impala SS was something special. Its owner, Dan Gurney, had it modified to go "Jaguar hunting on the weekends," said writer OCee Ritch in the July 1961 issue of *Sports Car Graphic* magazine. At the time, Gurney was in the thick of his Formula 1 career. He believed that the Impala SS, with just a few choice modifications, could successfully take on the Jaguar sedans competing in British saloon races of the time—saloon being the British word for sedan and not some pub crawl.

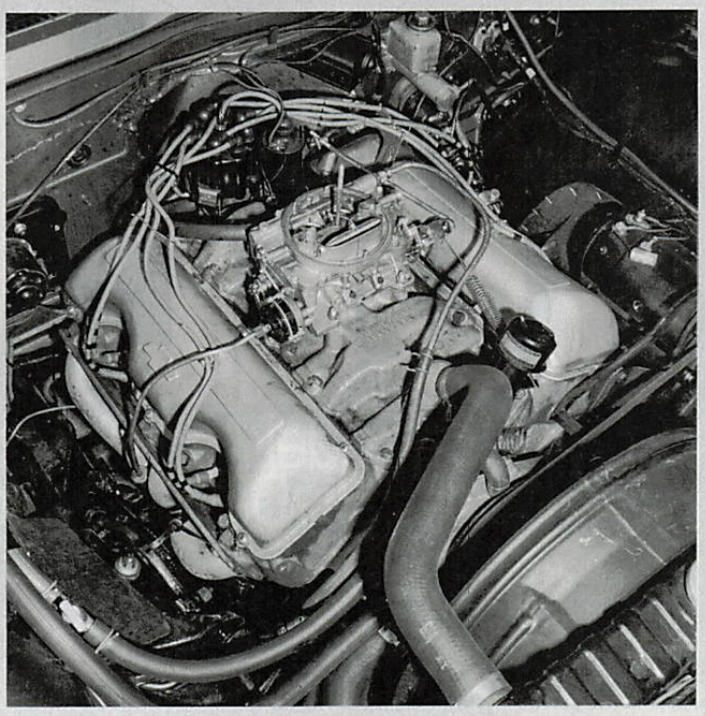
This was the first year Chevrolet offered the 409 in the Impala; it was rated at 360 hp and 409 lb-ft of torque using a single four-barrel carburetor. In Dan's car, the engine was mostly left alone. Local high-performance guru Bill Thomas and Bill Fowler just tore the engine down, inspected it, returned all clearances to stock spec, and then reinstalled it in front of the car's aluminum four-speed gearbox. "Even the jets in the stock four-barrel carburetor were left untouched," wrote Ritch.

It was the chassis that was the target of most of the upgrades. The car was ordered with Chevrolet's Taxicab & Police suspension, which included stiffer springs, heavier shocks, a beefier front sway bar, sintered-metallic brakes, and 15-inch wheels. A Corvette sway bar was adapted to the rearend, and the wheels were shod with 7.60x15 Goodyear Blue Streak tires. To help control brake temperature, Fowler made cooling ducts using a flexible heater hose. And while the car's manual steering was retained, they swapped in

a power steering box which gave the car 3.5 turns from lock-to-lock.

The modifications were certainly effective. Gurney's 2:16.6 lap times in the car at Riverside Raceway were 0.8 second quicker than the record set by Dave McDonald in a Corvette. "For a stock automobile which has not even been brought up to NASCAR specs, it borders on the incredible," wrote Ritch, reminding readers that this was a "fully equipped pleasure car," with radio, heater, "lavish upholstery—everything but air conditioning."

Gurney raced the car just once that year, at Silverstone in May. He was right about the Impala. He had built a considerable lead over the Jaguars before a broken rear wheel put him out of the race—on the last lap. He tried to enter the car in another saloon race later that summer, this time on upgraded NASCAR wheels, but was told the car did not meet FIA specs. Officially, there was a question as to the car's homologation for racing, but unofficially, it looked as though politics were used to keep him from making the locals look bad. With his hands full of other racing pursuits, Gurney sold the Impala to an Australian, who intended to do a little saloon racing of his own down under. The car is still there, from what we understand, awaiting a full restoration.

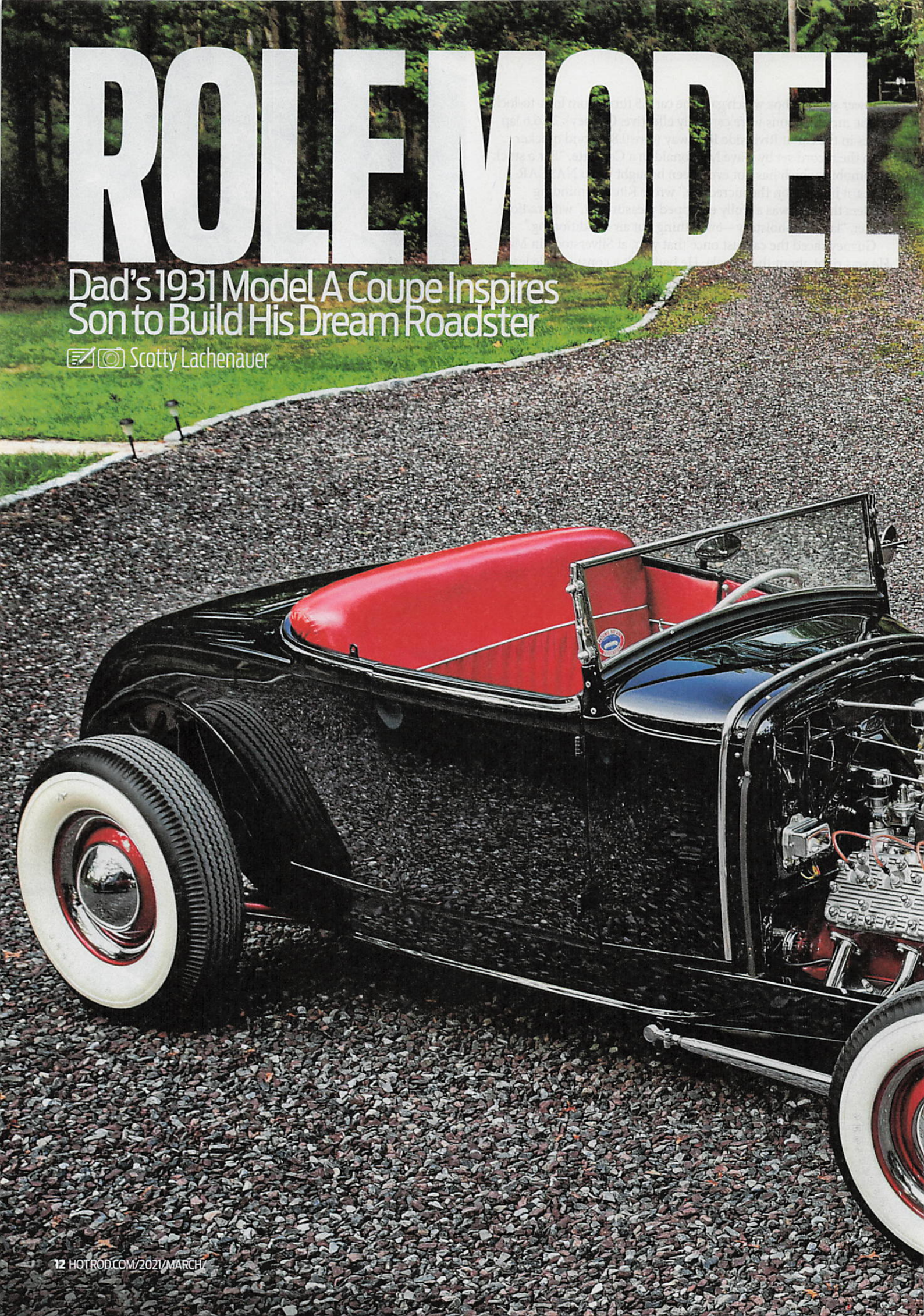


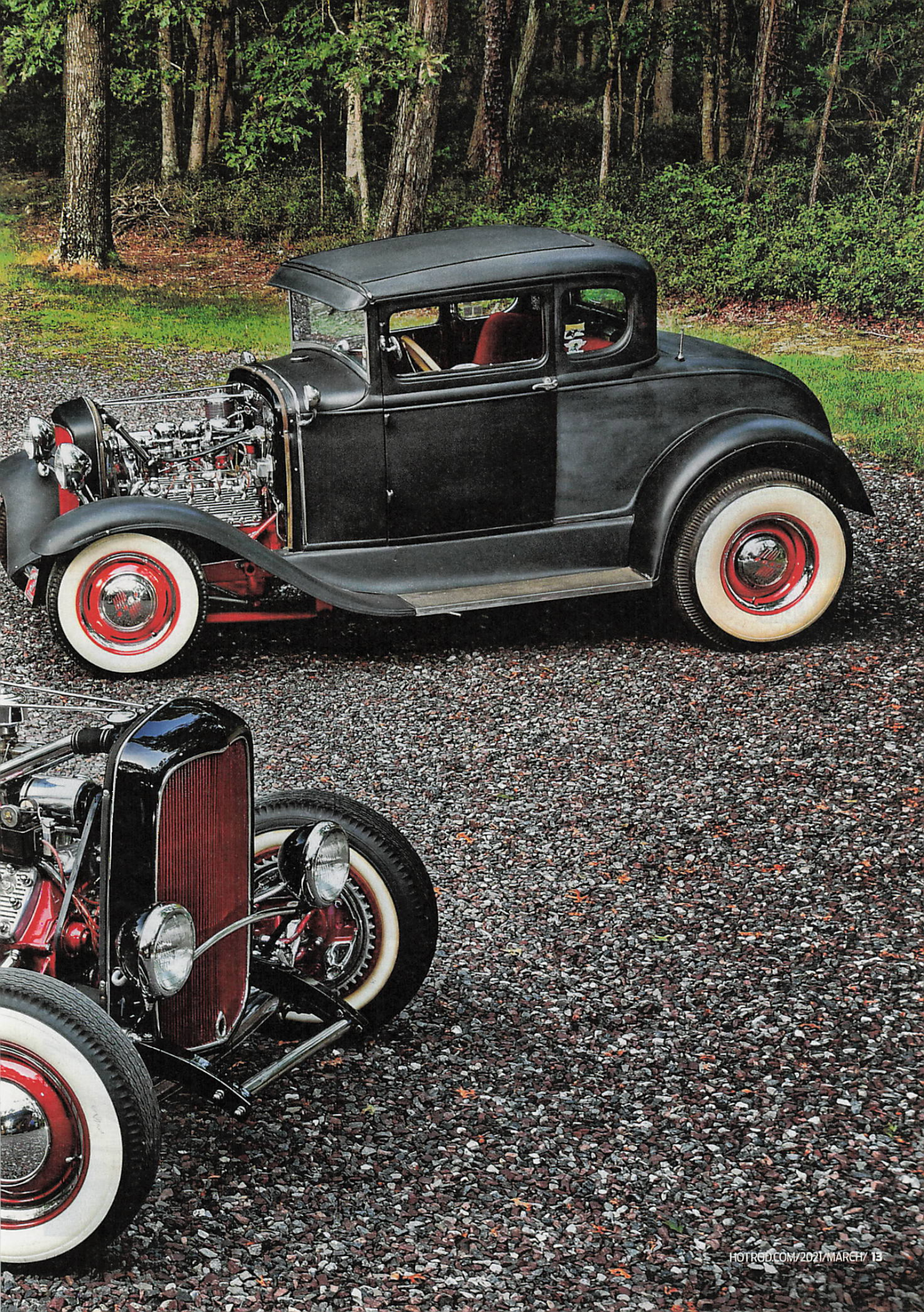
Steven Rupp &Drew Hardin Al Paloczy, Petersen Publishing Co. Archive

ROLE MODEL

Dad's 1931 Model A Coupe Inspires Son to Build His Dream Roadster

Scotty Lachenauer



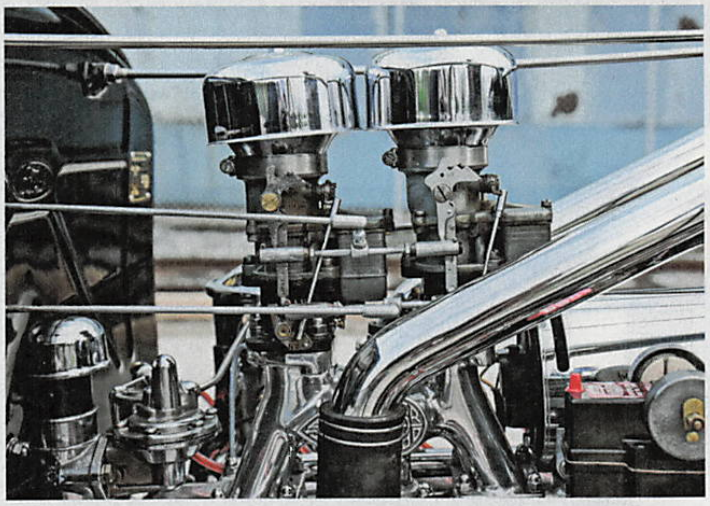


ROLE MODEL

Inspiration.

Or impact, encouragement, guidance—any way you define it, the lives we lead and the paths we take can be thoroughly directed by the people responsible for bringing us into this world.

Our parents are usually our first and foremost leaders in life, starting at birth and typically continuing even after they've left us. They look over us and care for us, and it's their daily directive that helps shape our lives. That's why many of us follow our parents in so many ways, including our chosen careers and also our favorite daily diversions. Love of the automotive hobby is one of those qualities that's commonly passed down from parent to child, and it's typical to see sons and daughters follow their parents into the garage and learn from them what their parents taught them a generation earlier.

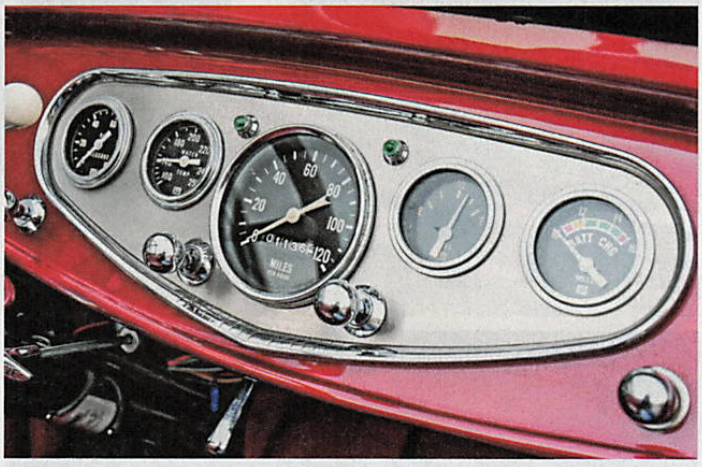


Nick Maneri Sr. and his son, Nick Jr., are from Mays Landing, New Jersey. Young Nick grew up under his father's hot-rodding tutelage, learning the basics of auto mechanics by watching his dad wrench on one of the several hot rods he's owned since his teens. "When I was little, I remember my dad's Model A in my grandmother's garage," Nick Jr. says. "At that time, he also had a '51 Victoria. I rode in that car and a '35 cabriolet he still has. I was probably about 8 when he brought the Model A back home and pulled the body off to redo the car again. By that time, I was getting old enough to help out."

A sporty '67 Mustang would appear in Nick Jr.'s teenage years, and it's a car he still uses on a daily basis. Later, it would be Nick Sr.'s '86 Ford pickup that the young gun eventually honed his skills on, teaching him basic bodywork and engine rebuilding. However, when it comes to the ride that was the constant presence in the family garage, it has to be Nick Sr.'s built-up Model A coupe.

SENIOR'S YEAR

"I bought my '31 Model A in 1963, the year after I graduated high school," Nick Sr. says. "I got it for $75, and I paid for it in



quarters because that's how I got paid when I was selling pretzels." The Model A was in the process of being turned into a hot rod at the time, and Nick continued that process. "The car was last owned by a guy named Billy Placek. He cut the bottom out of the car and started to channel it. A friend named Joe Fox welded the subrails back in, and I had the car back on the road the following year."

Nick bought the car with a hopped-up banger in it, but that didn't last long. "The first engine I put in it was from a '48 Mercury, backed by a '47 transmission with a Hurst shifter." North Jersey racer and ace mechanic Pappy Hough cut down the '37 banjo rear that went into the hot rod. A year later, Nick switched to a hot Ford small-block. He kept the Model A springs in the front and back and built the car on the original frame, splitting the wishbones up front. A Cragar dropped axle and reverse-eye spring up front brought the front end down and gave Nick the rake he desired.

A '32 grille sits up front, the trunk handle was shaved to clean up the coupe's skin, and a set of '51 Pontiac taillights was mounted out back. Out on the corners, Nick installed 15-inch Mercury steel wheels that helped give the ride an understated look.

Over the years, the Model A went through some changes. The Ford was painted in a mid-'60s Ford truck yellow for a long period of time. Later on, Nick installed a T10 four-speed and a '57 Olds rear, as well. It has been driven more than 100,000 miles under Nick's ownership, including some passes at Raceway Park in Englishtown, New Jersey, where it ran consistent 13s. It was also Nick's wedding car in 1974.

Later on, Nick built a new engine for the Model A. "The new powerplant is a '51 Ford truck motor bored to 3⅝

with a 4-inch stroker Mercury crank," he says. "The flathead has Offenhauser heads and an intake manifold, the latter with three Stromberg 97s. The engine is ported, relieved, balanced, and blueprinted and backed by a '39 Ford transmission feeding a Culver City quick-change rear. The cam is an Isky 400 Jr. track grind. The headers are Red's." Last but not least, the yellow paint was stripped, and the car repainted in flat black primer. It will stay that way for the time being, but plans are being made to spray it yellow once again and put her back on the road where she belongs.

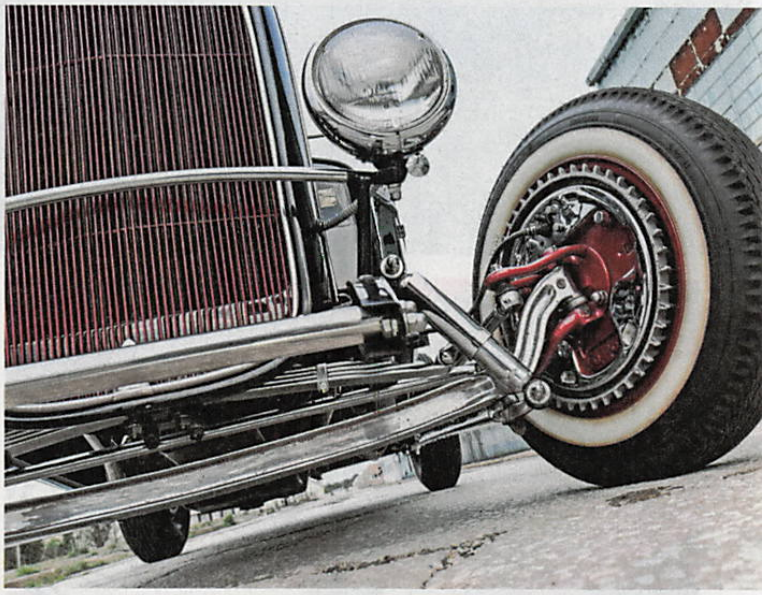
SON SHINE

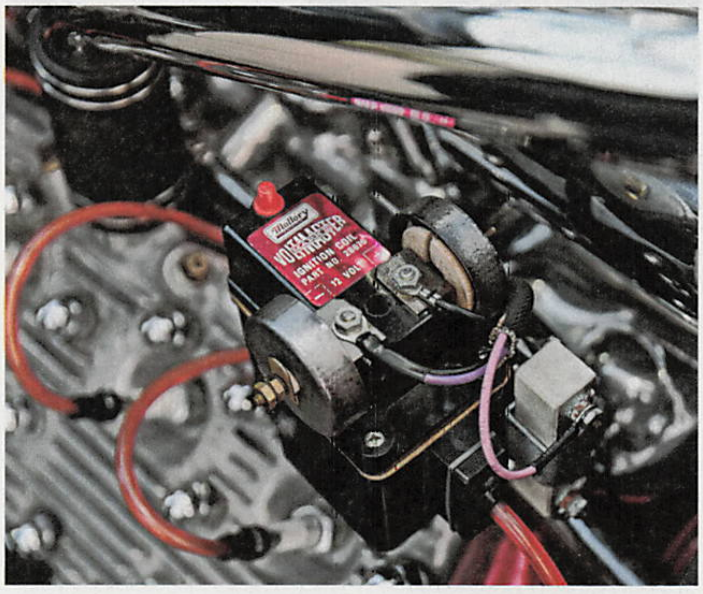
Nick Jr. is one of those kids who just could not stay out of the garage, especially when Dad was in there working on one of his many hot rod projects over the past 30 years. His father's love of the hot-rodding hobby rubbed off on young Nick, and it helped push the youngster to follow in his dad's footsteps in the garage and out on the street.

Cars would come and go over the years, as Nick worked steadily on a series of muscle cars. But soon he came to realize he needed to follow a dream he had since he was a kid. "I always wanted to build a traditional roadster to call my own, so a few years ago I actively went looking for a '30 to '31 roadster to build into a hot rod, with a lot of influence from my pop."

During his search for a suitable starting point, "there was a Model A auction in our area, and in the mix were a few rough roadster bodies," Nick says. "However, the night before the auction, my friend spotted a better deal online, so we checked it out and ended up buying it. It was a '31 Ford roadster that had been in this certain gentleman's family back to the early 1960s. It was meant to be." That night, they met at the guy's house with a trailer and cash and brought the needy roadster to the family garage.

A '32 frame was sourced while Nick tore through the body, getting it down to bare bones. "I soon found the floor was just plywood over the subrails. I then modified new subrails and fit them by pie-cutting and bending them over the '32 frame." From there, the body needed a series of patches to clean up the metal, and he also replaced the teardrop firewall with an earlier piece. Other modifications include a cool custom bead-rolled floor pan and a '32 cowl vent donated from a vehicle that





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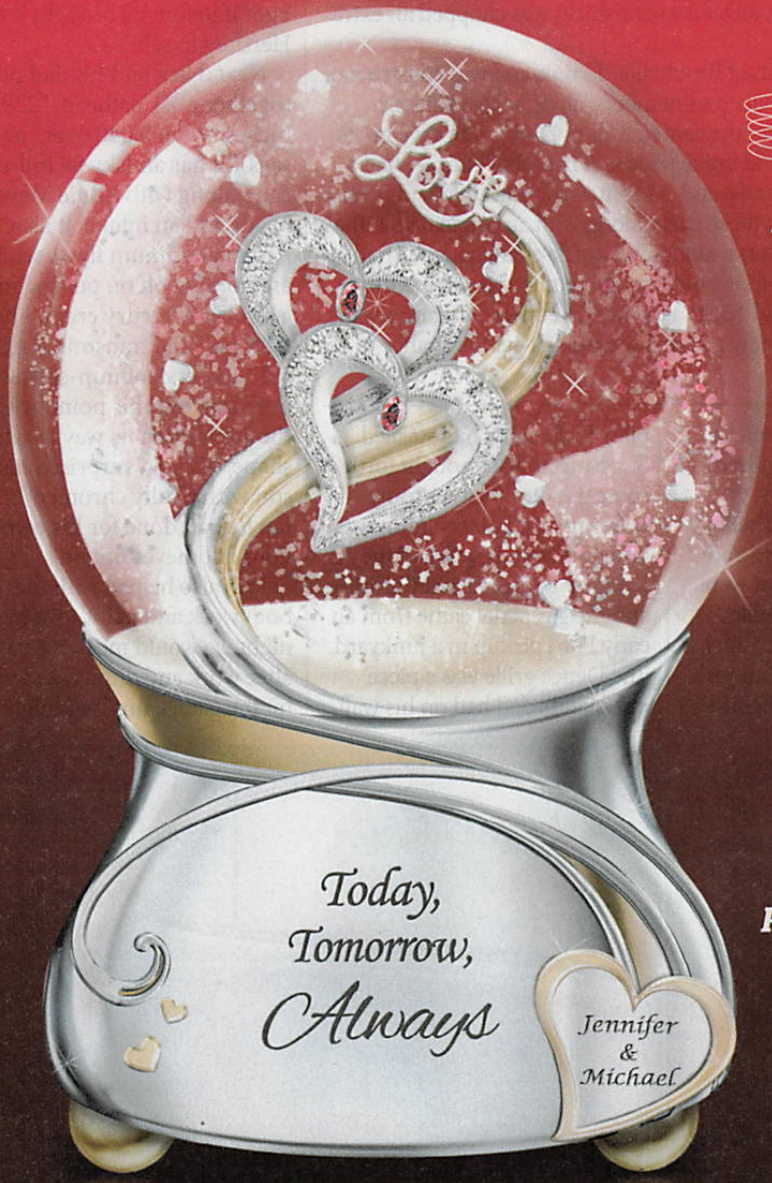

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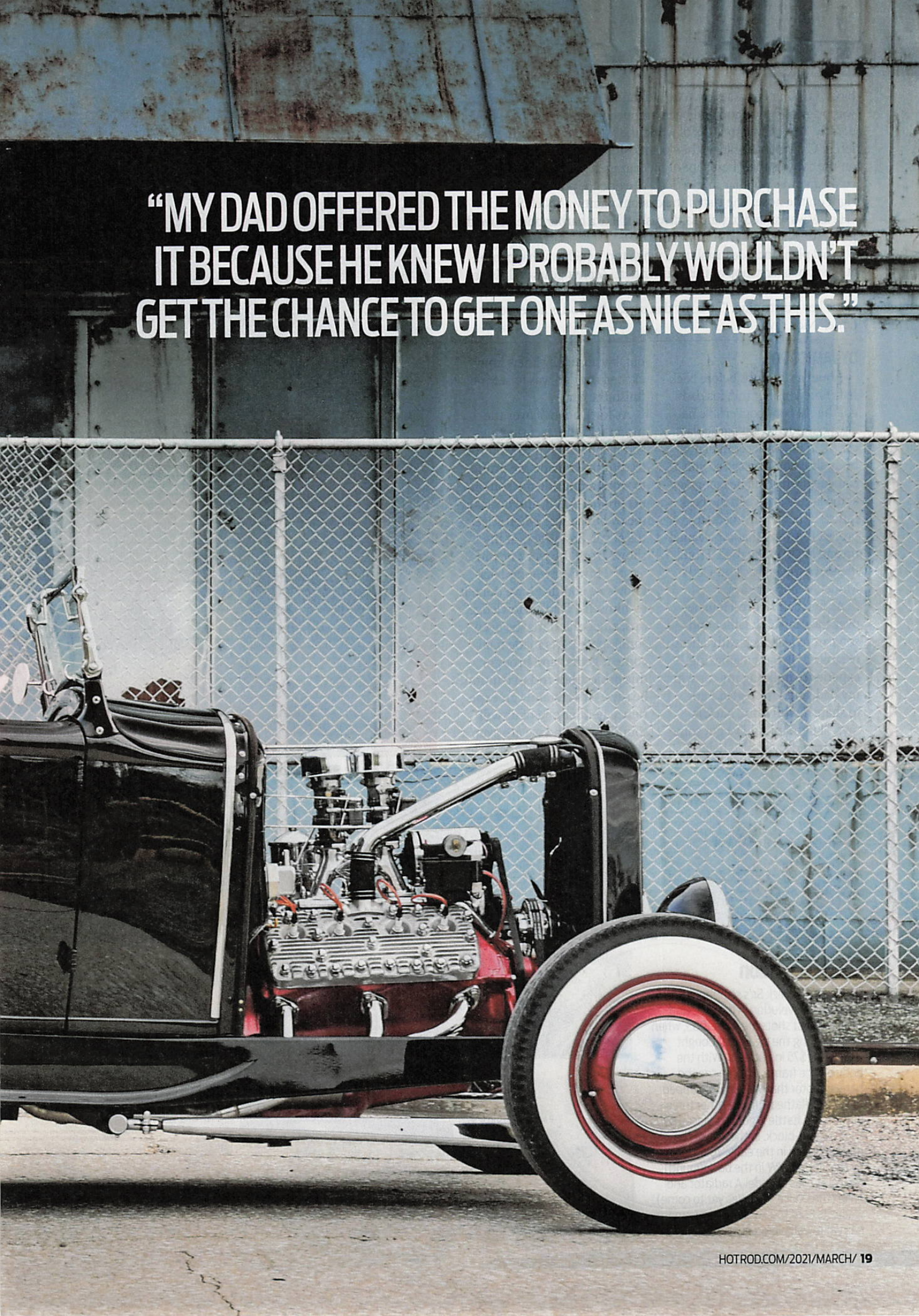
had its vent filled. Lastly, a Deluxe windshield was chopped an extra 3 inches and installed.

The frame was built out of Brookville '32 rails and was constructed with the Model A's original crossmembers, along with a Chassis Engineering X-member in the center. A donor '46 frame gave up its juice brakes and clutch and brake pedals. A friend of Nick Sr. had a chrome Mor-Drop front axle and '32 split wishbones that had been chromed. After grabbing these parts, along with an original seat, the next piece of the puzzle was a Halibrand quick-change that he had. "I told him I was about tapped out of cash, but he showed me the Culver City piece anyway," Nick says. "My dad offered the money to purchase it because he knew I probably wouldn't get the chance to get one as nice as this."

Nick Sr. helped out along the way with parts he had aquired over the last 50-plus years, things like a Stewart-Warner gauge panel, Buick drums, and countless other pieces that were put into service for this build. "He also had three steel 15-inch Ford wheels, and my friend Josh Sooy had the fourth laying in a pile of wheels he had stashed." Swap meets also brought forth some goodies. "The chrome column-shift F100 column was bought before I even had the car. I got the '32 lightbar at Carlisle, and the gas pedal came from an early Ford pickup in a junkyard. The Deuce grille was a piece my friend's dad had on his wall. I got it before he brought it to Hershey to sell."

Next, Nick and his dad put together a '41 flathead, "239 inches bored 0.040 over," he says. "It has an Isky 88 full-race cam, along with Eddie Meyer heads and an intake. It also has an aluminum flywheel. We are holding off on putting in a stroker Mercury crank until later on." The transmission is a '50 Mercury column-shift with overdrive. At this point, with the car well on its way to taking shape, Nick Sr. surprised his son with a fully chromed '35 fan he had done for his own '35 Ford and never put on.

Josh also helped with the bodywork and paint. "Every night we would meet at 8 p.m. after work and dinner, and we'd hit the garage until midnight,


"MY DAD OFFERED THE MONEY TO PURCHASE IT BECAUSE HE KNEW I PROBABLY WOULDN'T GET THE CHANCE TO GET ONE AS NICE AS THIS."

block sanding our asses off. We had found previously that the car was originally blue and had been stripped to the metal some time before." After three months of work, the guys had a stunning paint job in Chromabase Black, thanks to Josh's spray gun. The red used on the car was their best shot of recreating the old Buick Titian Red color that was popular in the '50s. All evidence points to hitting it right on the nose. The last of the custom paint was Nick Sr.'s idea. "He always wanted to paint a driveshaft like a barber pole, so we did just that," Nick says with a laugh.

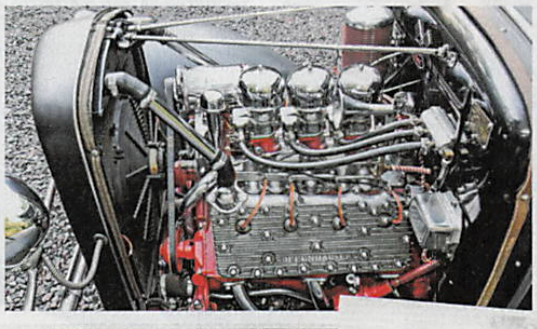
Final plans include installing a white top, which was happening at the upholstery shop as this was written. Zephyr gears will also be added, along with the aforementioned Mercury stroker crank and some key pinstriping. "Like my dad says, a hot rod is never really done," Nick says.

DYNAMIC DUO

About six months before Nick Jr. finished his hot rod, his dad got the '40 Ford convertible he always wanted. That particular car sat in the back room of a body shop for 40 years, so you can guess what will be going on at the family garage in the near future. "The next immediate project is getting that car cleaned up and back on the road. From there, we will be back on Dad's Model A," Nick Jr. says.

As for their hot rod journey over the years, the father and son can reflect back with a heap of smiles. "It was an amazing experience building my car with my dad, and I'm so glad I got to share it with him," Nick Jr. says. "I'm thankful I've got some great friends who also helped out, because they knew how excited my dad was to see me finish the car."

As for Dad, he's over the moon with the fact that his son is following in the hot rod tradition. "It made me proud to work alongside my son on his project A/V8, and it makes me even prouder when I see the accolades he gets at the shows from the work he did on it." However, young Nick knows he couldn't have done it by himself. "Dad's knowledge, tips, advice, and maybe even some spare parts made it all come together and brought this project hot rod to fruition," he says. "It's certainly an experience neither one of us will soon forget. And we are even a little closer for it. HR



Coupe Evolution

Photos from Nick Sr.'s scrapbook show the coupe's evolution in the '60s and '70s. The first shots are from 1963, when Nick (holding the cigarette) bought the car for $75 in quarters. With the body off the frame, you can see the banger motor that was soon swapped for a Merc flathead. In the other three photos, the flattie is gone, replaced by a Ford small-block. In the last of the photos (taken in the early '70s, judging by the vintage VW in the background), the coupe has a Model A radiator and grille (the Deuce shell was yet to come), wears its Ford truck yellow paint, and has whitewall pie-crust slicks.

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Sexy Thing

DENNIS MARIANI'S BRIZIO-BUILT 1941 WILLYS

John Gilbert Jorge Nuñez

Straight from the factory, a 1941 Willys coupe was a sexy thing with curvaceous lines reminiscent of a larger 1940 Ford. But under the hood, it was not what men of the future would be looking for.

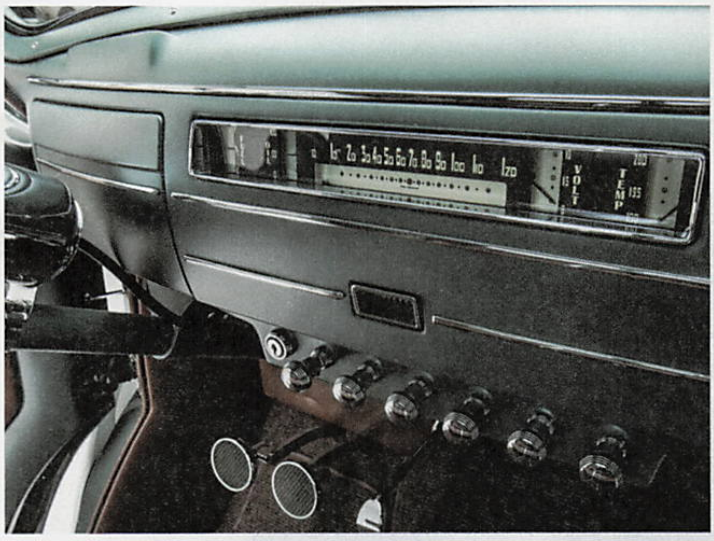
The Gasser Wars came, and a host of old cars with lightweight bodies would find themselves drafted. From 1933 models until the early 1940s, the bulk of Willys automobiles found themselves slaving at a drag strip.

EBONY ICON

The story of Dennis Mariani's 1941 Willys was that of a car plundered for its body to labor long nights on the strip, but its destiny would be unlike that of its peers. Dennis worked out a deal with Don Orosco to take possession of the former drag car, then enlisted Roy Brizio Street Rods to restore the 1941 Willys to its former glory, while adding a few enhancements.

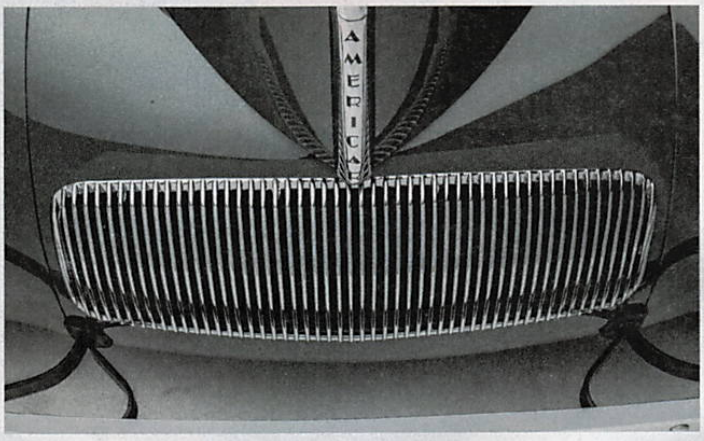
A strong foundation with a cool stance is at the heart of every iconic hot rod. Brizio's Dan Hall completed a 102-inch wheelbase Art Morrison chassis with QA1 coilover shocks and 12-inch Wilwood disc brakes at each corner. The makeover also included rack-and-pinion steering by Art Morrison, a four-link rear suspension, and 16-inch Wheel Vintiques wheels with Coker Excelsior radials.

Brizio Street Rods outfitted an LS3 engine from a 2015 Corvette with a custom intake fabricated in-house by Dan Hall. Ancillary items include an Edelbrock water pump, Powermaster alternator charging an Optima battery, and a Vintage Air Sanden A/C compressor. The exhaust system starts with Sanderson headers and finishes with Stainless Specialties mufflers. The cooling system features two Spal electric fans and a Rick's Tanks fuel tank that incorporates an Aeromotive fuel pump. The transmission is a Tremec TKO 600 with an M.D.L. Kevlar clutch and pressure plate. It also includes a Currie 9-inch rear axle with 3.70:1 gears and an Eaton Truetrac differential.



The custom interior includes the original gauge cluster upgraded with Classic Instruments gauges and custom billet aluminum vents made by Steve Moal. The original steering wheel was restored and shrunken by Dennis Crooks. A Lokar shifter pops out of new steel floors fabricated in-house by Brizio Street Rods, and complemented by a set of Lokar pedals. For sound deadening and insulation, Dynamat was used underneath German square weave carpet. The seat frame is genuine 1941 Willys issue; to it, Dave Putnam added hand-shaped high-density aircraft foam, then upholstered it in baseball glove brown leather. He also made the matching door panels and leather shifter and emergency brake boots. Dan Laughlin Customs added a flattening compound to custom Glasurit Cloud Mist Gray exterior color to achieve interior finishes. Sherm's Custom Plating handled all the exterior brightwork, including the chrome plating on the original bumpers and grille. From start to final finish, Dan Laughlin Customs sprayed Glasurit paint products, including the final finish of custom-mixed Cloud Mist Gray. Back in the day, it was quite common to find a Willys with a tilt fiberglass front end, so much so that an old-timer might look at this 1941 Willys with steel front fenders and think the car might be a fake.

It couldn't have been more than three weeks after Roy Brizio Street Rods handed the keys to Dennis when he filled the trunk with luggage and made a banzai run to Deuce Days in British Columbia, Canada. He repeated the journey the following year. As much as cars built by Roy Brizio Street Rods have a reputation for show winning quality, Roy's cars have the reputation of being able to pull down long miles at high speeds with bulletproof reliability. HR



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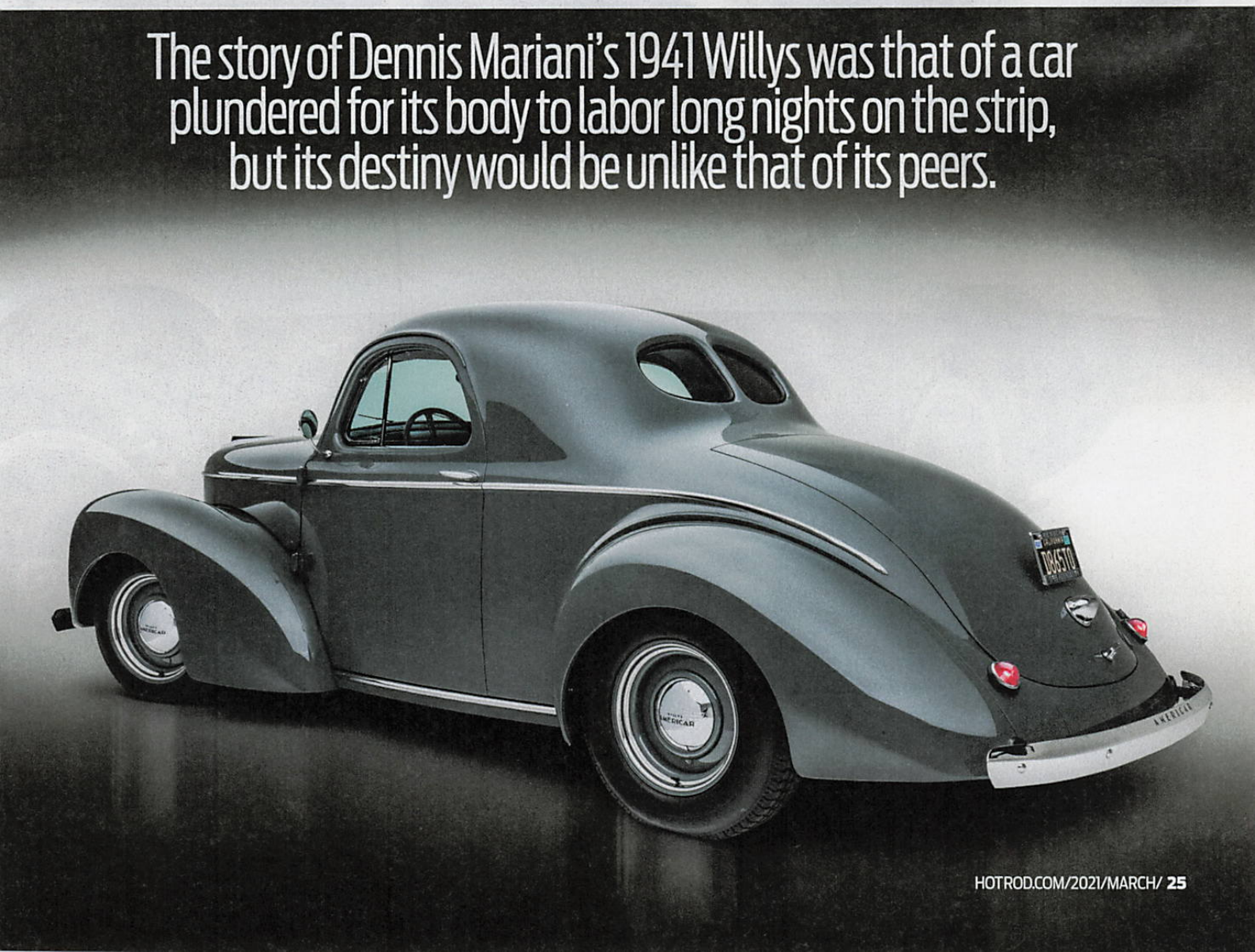


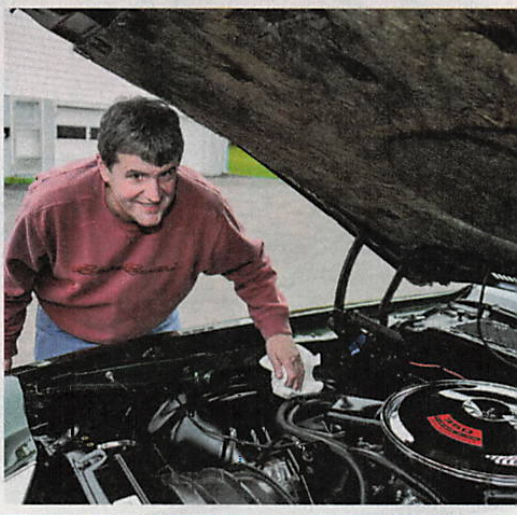
Z28
GOODYEAR

LABOR OF LOVE

This 1970 Chevrolet Camaro Z28 Gets Show-Winning Restoration

Jerry Heasley

LABOR OF LOVE



Frank Arone's 1970 Chevrolet Camaro Z28 is the latest in a group of nearly two dozen muscle car restorations that he has done. He owns a restoration shop that, while it is a business, "is not highly profitable for me," he admits. "It's a labor of love."

Frank restored many of these muscle cars prior to opening this restoration facility, which goes back to the year 2000. He was a muscle car enthusiast first.

Frank has been painting cars since he was 12 years old. His interests have covered Corvettes to sport trucks, four-wheel-drives to SUVs, and now at 62, his interests have circled back to muscle cars, which are what he really likes. Over the years, he's amassed some noteworthy models, including a 1969 COPO Camaro, a 1969 Z/28, and a 1967 Yenko Camaro, among others.

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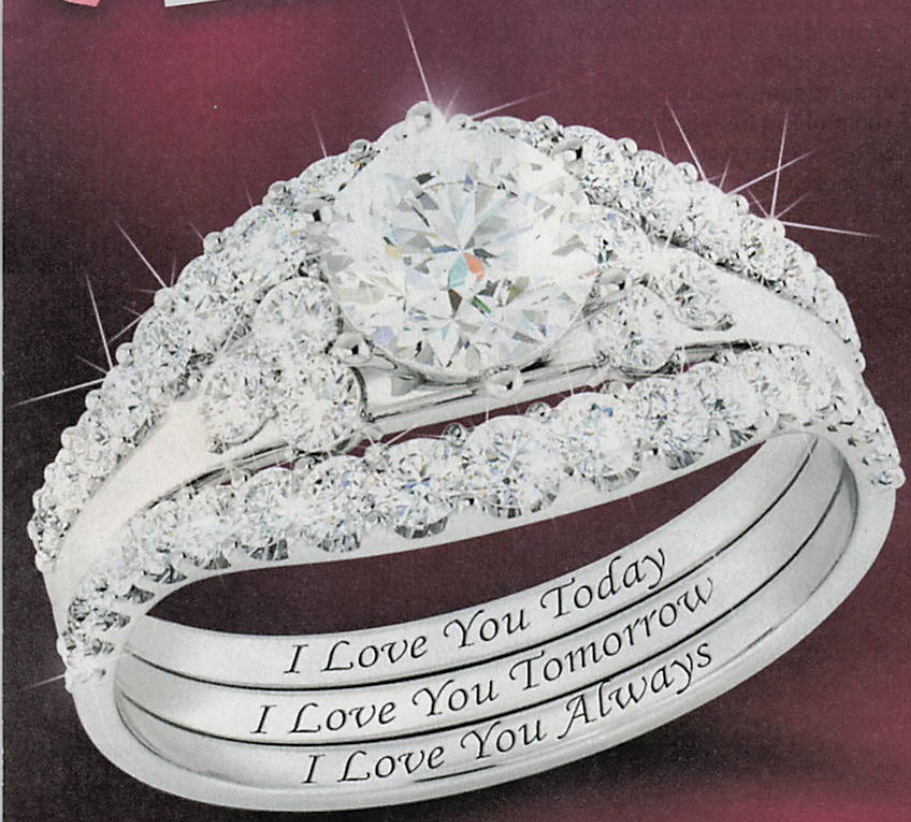

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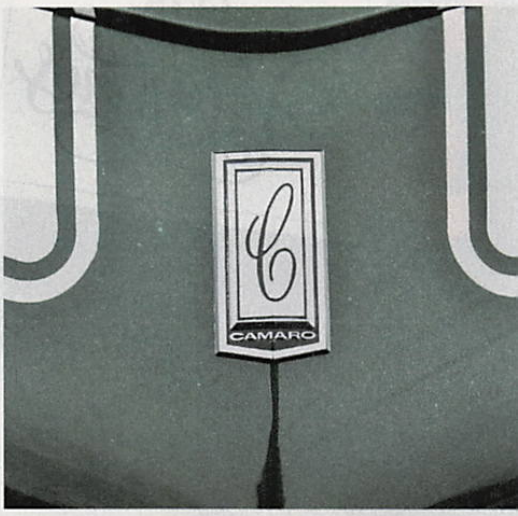
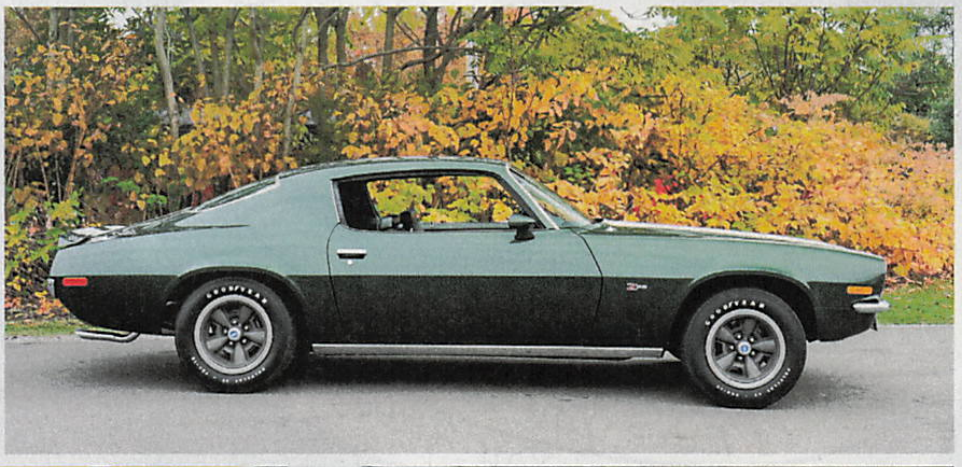
LABOR OF LOVE

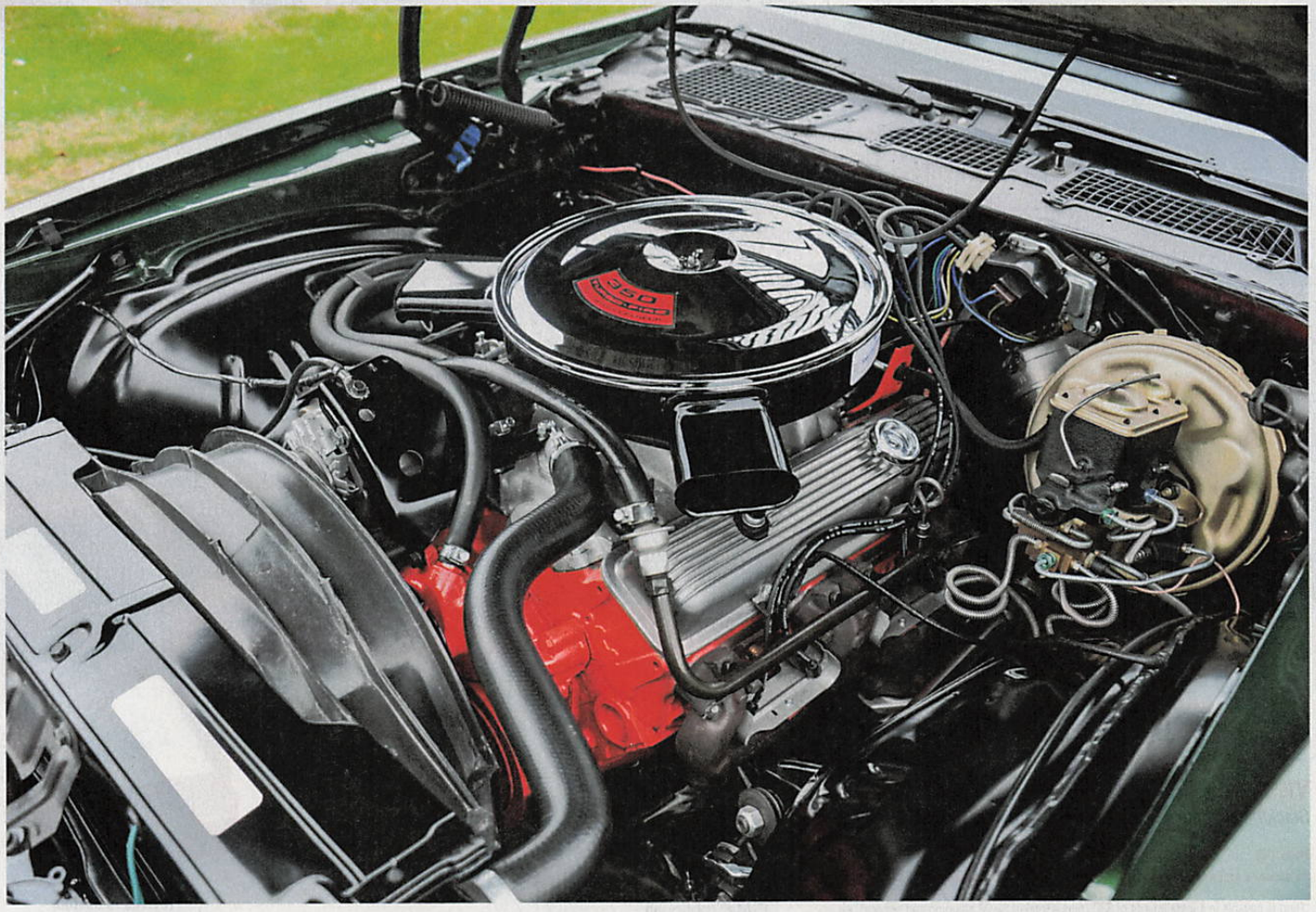
When describing the restoration of this 1970 Z28, Frank says he wanted to go over the top. "Not a lot of people have really done the second-generation Camaro to this level. There's a few out there, but we just set out to try to make the car as good as we could," he says.

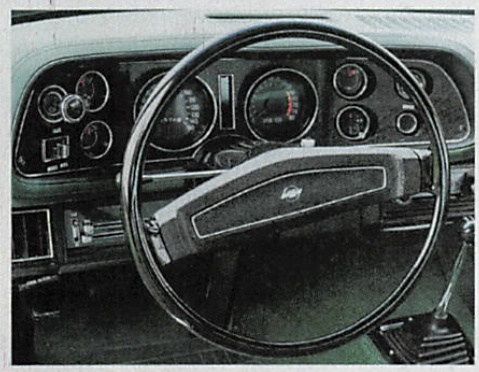
This challenge started when he first ran across the car. It was complete with everything there including the smog and exhaust manifolds in the trunk. It had just 35,000 miles on it. The original owner was a doctor who bought this Z28 for his son. Frank found a Penn State parking pass on the bumper, so the doctor's son probably got this car as a graduation gift. The car showed up at GM Carlisle about 12 years ago and was purchased by a friend. Eventually, Frank bought the car and fully restored it over a period of seven months.

The Camaro's 350-cubic-inch engine is full of original parts, including radiator and heater hoses. The original smog pump was in the trunk, so no problem finding those parts. The interior is original, except for new carpet. Frank colored the original seats with a vinyl additive to match the factory green. The wheels are 15x7 five-spoke Rallys, which are different from the basic Camaro Rally wheels, which were 14x7s. The F60-15 Polyglas GT tires are original, not reproduction. Yes, he did have to buy a lot of new trim. He purchased









N.O.S. emblems, headlight bezels, and weatherstripping. He re-chromed bumpers and door handles. The paint had faded from being parked outside. There was also some surface rust near stone chips on the body. Frank is a proficient painter and used this car as a means to try out a new paint brand, saying, "It's my own car, and I didn't have to answer to anybody if something failed." Obviously, the paint didn't fail, and Frank is very pleased with the results.

Frank's goal was to score high at the Camaro Nationals. The first year he showed it, the car was judged as 12 or 14 points from a perfect score. "Then we did a few things on it, took it back the following year, and scored over 5,000 points. We got bonus points because of all the paperwork. I have a Protect-O-Plate and original tires and got points for those. The radiator hoses, heater hoses, all those are original to the car. It has an original battery in it, too. That got me bonus points," he says.

Enthusiasts can weigh the collectability of the first-generation Camaro over the second, but for Frank, there is sport and fun in a restoration. It's also very difficult to find a first-gen Camaro with original sheetmetal and all the parts intact. For his part, Frank says, "I have a liking for the second-gen Camaro, and I feel those cars are up-and-coming. They seem to be gaining more and more popularity." We suspect his work will inspire other second-gen owners as well. HR

THE IN-BE

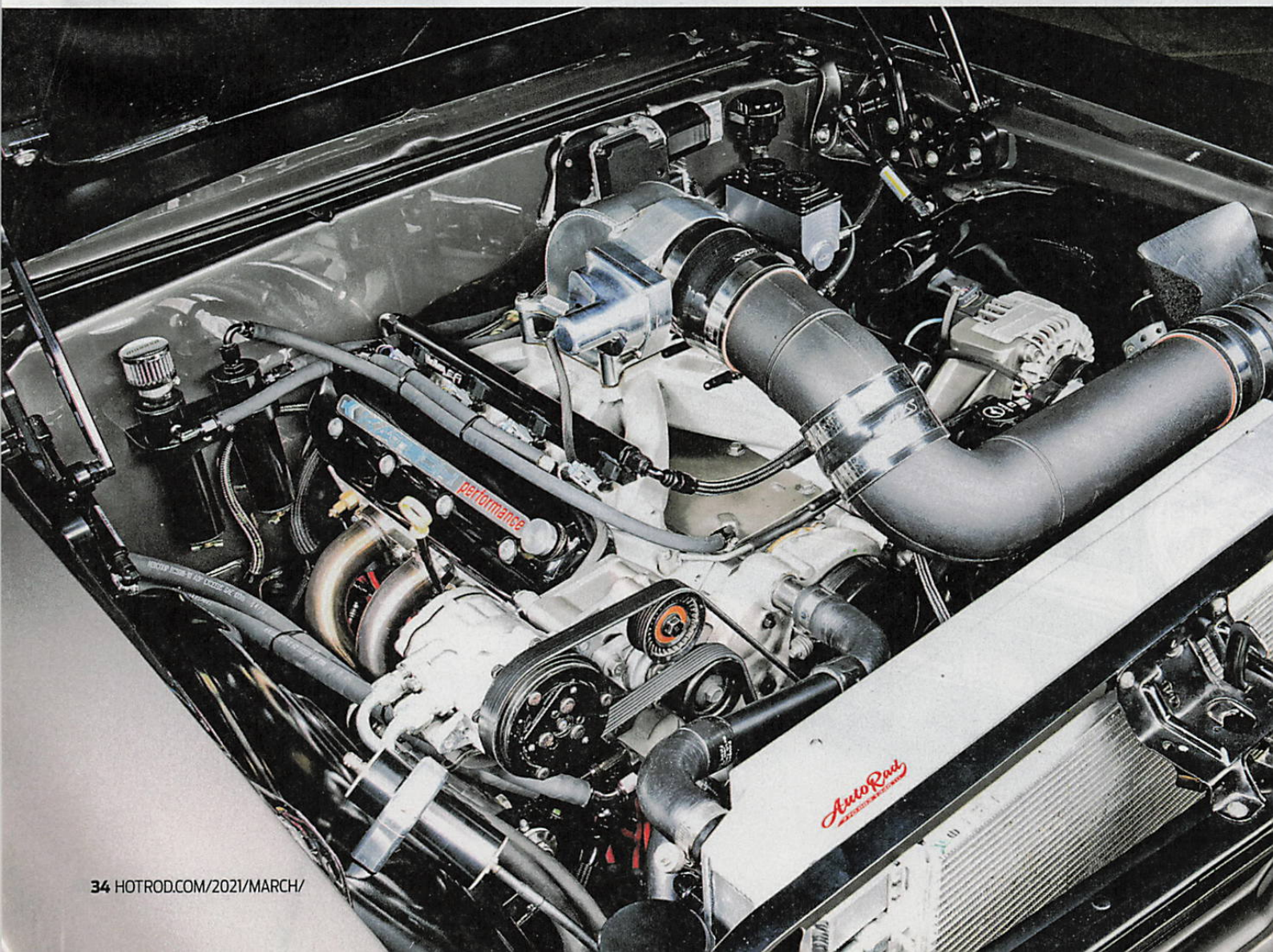
TWEENER

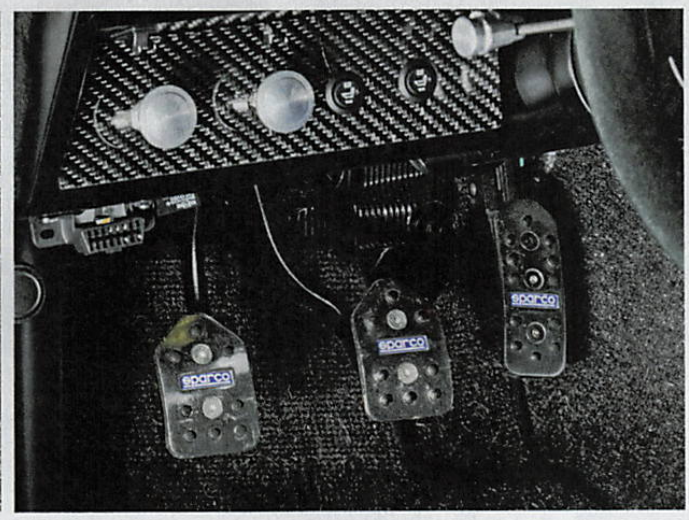
This Budget-Built Nova Turned Into a Pro Touring Terror.

John Machaquiero

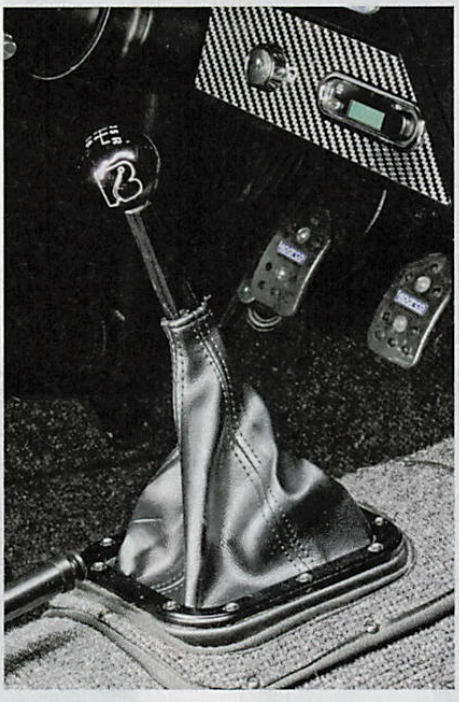
THE IN-BETWEENER

When you set out to build a car, arriving at that happy place usually means budgets and goals have to come together. For Jeff Cleary, his 1970 Nova project started out with a very specific set of goals that he envisioned culminating in what he defines as an "in-between car." He explains, "I was racing an LS7-powered 1967 Corvette and was in the process of building a 1965 Corvette coupe. Knowing that the coupe was going to take longer to build, I decided to take a standard-platform car and throw everything from the Detroit Speed Inc. catalog at it. My goal was to speed up the build process but not do anything else to it. I was going to put a rollcage in it, use as much of the powertrain as I could, and just upgrade the suspension and brakes." He was in the process of sending the '67 Corvette to a new home, so the Nova's purpose was to fill a temporary void.





Found on eBay, he points out, "It was a really sharp car when I looked at it, but even then, I found some issues. This Nova was a cupcake car—it had a lot of good frosting on it, but the cake itself wasn't very good." Originally a base-model car, it had been cloned as an SS with white paint, a Yenko stripe, and some Torq Thrust wheels. The interior was pretty nice, and under the hood was a mildly warmed-over 350 small-block backed by a four-speed.



After selling the '67, work on the Nova commenced, and it was on track as planned, but as Jeff started cutting into it, hidden rust proved to be the monkey wrench in his plans. Underneath the white veneer, he found a multitude of rusty sins that he couldn't overlook. Not one to cut corners, Jeff began the process of replacing the rusty panels. Once the bad stuff was removed, the only things salvageable on the Nova were the basic structure, roof, and one door. It was at that point that his mindset shifted. With the addition of the Detroit Speed subframe, the idea to ditch the small-block and four-speed gained traction. His updated plan involved the installation of an LS engine backed by a

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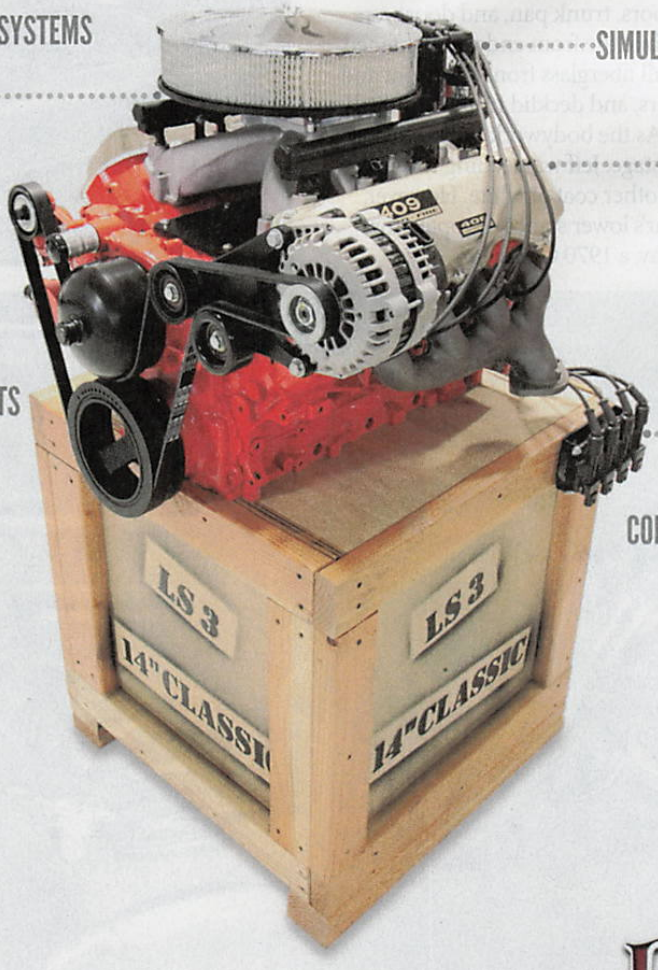

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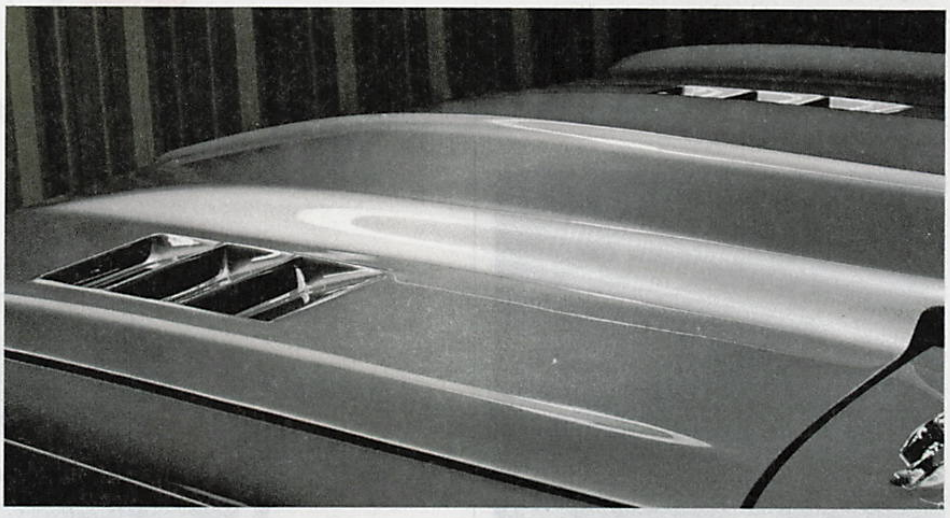
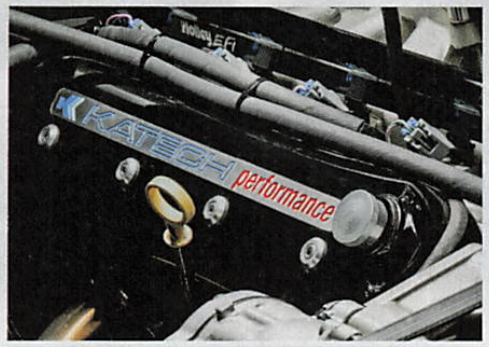
THE IN-BETWEENER

T-56 six-speed. Fabrication work to accept this hardware was entrusted to Matt Wirt at Racefab Engineering.

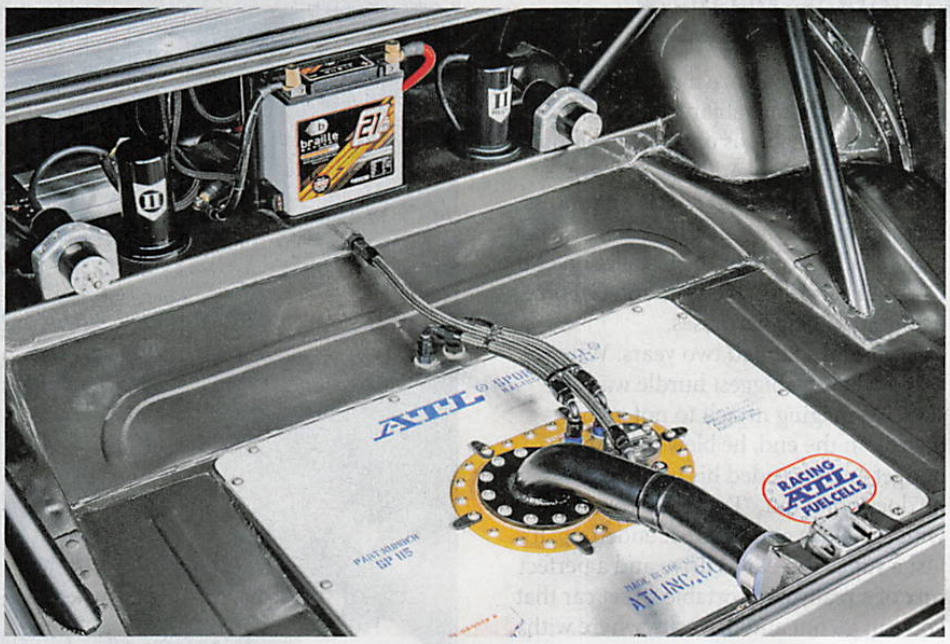
On his updated plan, the Nova got a new skin and shed a few pounds. The rotten quarters, floors, trunk pan, and door were replaced, while the front end was lightened up with a full fiberglass front clip, front and rear bumpers, and decklid from Unlimited Fiberglass. As the bodywork progressed to the primer stage, Jeff was leaning toward applying another coat of white. However, given the car's lower stance, he opted for Shadow Gray, a 1970 GM color.





When it came time to pull the trigger on an engine, Jeff went knocking on Katech's door. Having dealt with them on a prior build, this choice was an easy one to make with one of their turnkey LS3 crate engines, which he would mate to a Tremec Magnum T56 Tranzilla six-speed built by Rockland Standard Gear.

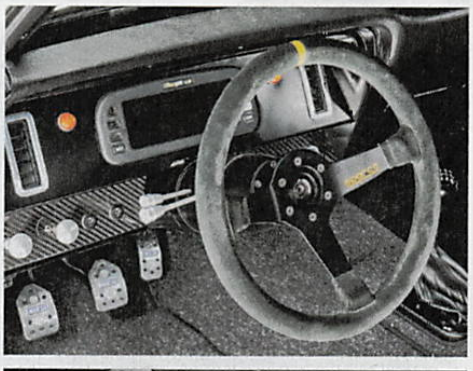
The one constant from the beginning was the use of Detroit Speed hardware. Up front, Jeff fitted one of their subframes, and at the rear he added their QUADRALink assembly. Detroit Speed springs and JRi triple-adjustable shocks, along with Baer six-piston calipers and 14-inch rotors were installed at all four corners. That hardware combined with sticky BFGoodrich G-Force Rival S tires mounted on Forgeline GA3 wheels gave the Nova a wicked stance. Jeff noted as things evolved, "This thing really started to be a badass car."

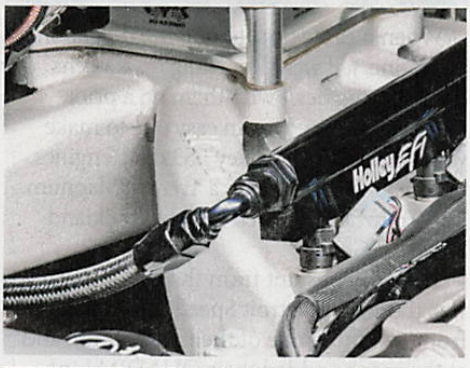


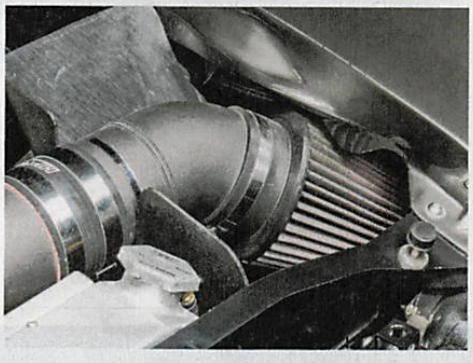
THE IN-BETWEENER

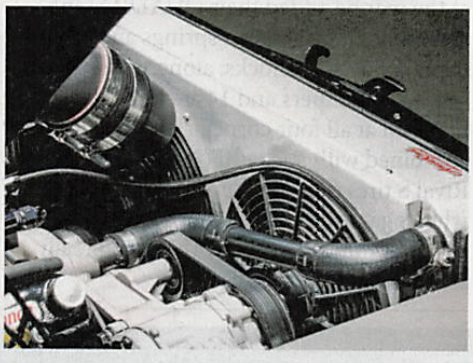
One point of balance that he didn't want to lose was the car's ability to be street driven comfortably as opposed to all-out track performance. Addressing those concerns played into the decision process surrounding the interior. Part of it visually looks stock, except for the installation of the Corbeau A4 adjustable seats and G-Force five-point racing harnesses.

The build spanned two years. When asked what the biggest hurdle was, Jeff says, "Managing myself to not go overboard." In the end, he blew through his budget and exceeded his initial goals, but he does point out, "I'm really comfortable with the Nova and where it ended up. It's just a super fun car to drive and a perfect mix of a really comfortable street car that you can go out and drive anywhere with the air conditioning on, but it's also a really capable car on the track and autocross." HR









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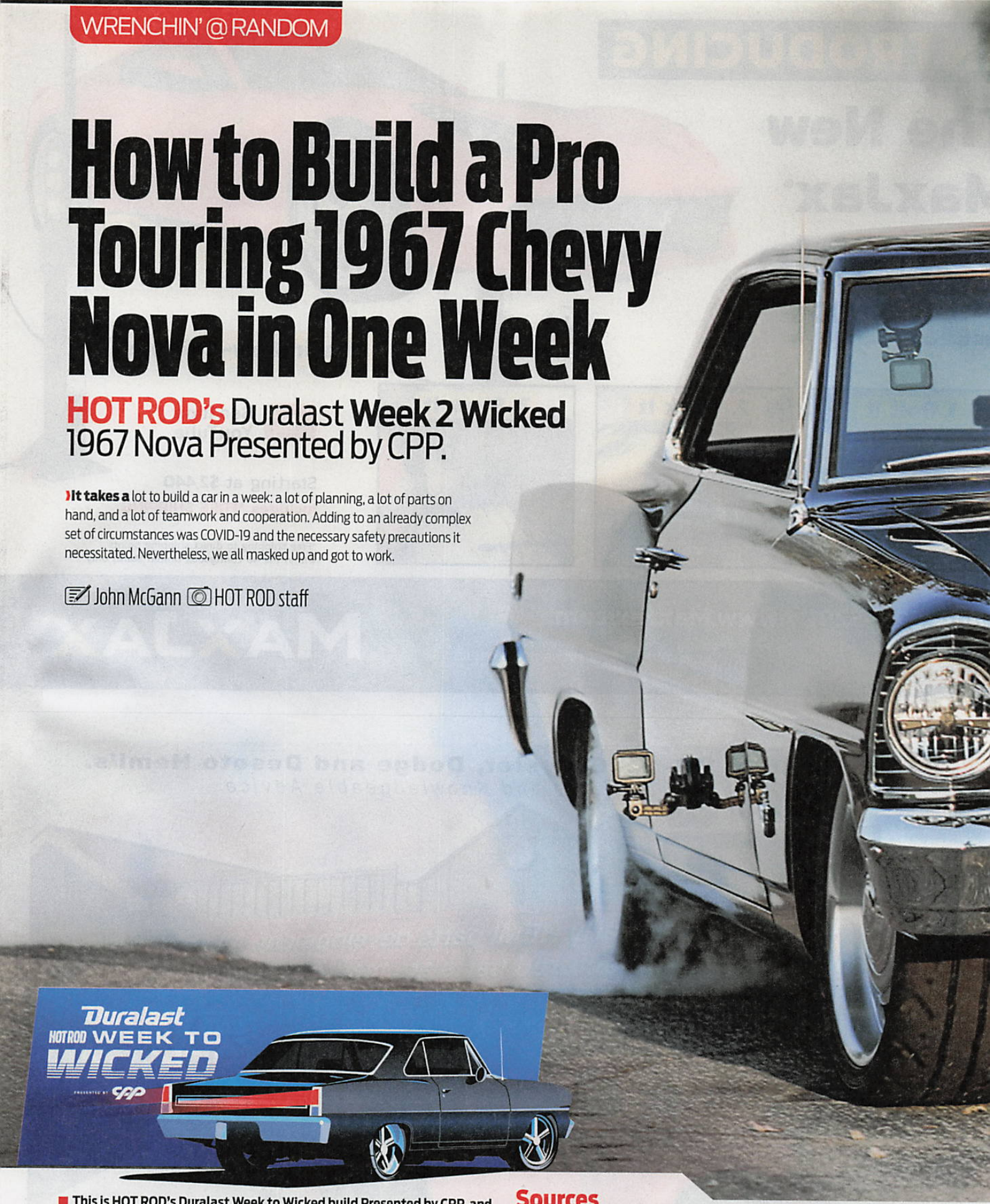
How to Build a Pro Touring 1967 Chevy Nova in One Week

HOT ROD's Duralast Week 2 Wicked 1967 Nova Presented by CPP.

It takes a lot to build a car in a week: a lot of planning, a lot of parts on hand, and a lot of teamwork and cooperation. Adding to an already complex set of circumstances was COVID-19 and the necessary safety precautions it necessitated. Nevertheless, we all masked up and got to work.

John McGann HOT ROD staff



This is HOT ROD's Duralast Week to Wicked build Presented by CPP, and our subject was an extremely clean 1967 Chevrolet Nova. It was a mostly stock rolling chassis with really nice paint, which made it an ideal candidate for our weeklong build. With help from Duralast and CPP, we planned to modernize this car with brake and suspension upgrades as well as a modern, fuel-injected engine and smooth-shifting overdrive transmission. The goal was to build a fun and reliable daily driver with enough go-fast parts to keep up with the new sports cars, should the occasion arise.

Sources

American Legend Wheels; 855.924.3100; americanlegendwheels.com

AutoRad Radiators; 770.983-1345; autoradradiators.com

Bowler Performance Transmissions; 618.943.4856; bowlertransmissions.com

Classic Performance Products; 714.522.2000; classicperform.com

Dakota Digital; 605.332.6513; dakotadigital.com

Duralast Auto Parts; duralastparts.com

E3 Spark Plugs; 904.567.5994; e3sparkplugs.com

E-Stopp Corporation; 888.688.6348; estopp.com

Falken Tires; falkentire.com

FiTech Fuel Injection; 951.340.2624; fitechefi.com

Holley; 866.464.6553; holley.com

Lokar Performance Products; 877.469.7440; lokar.com

Quick Time Performance; 866.464.6553; holley.com

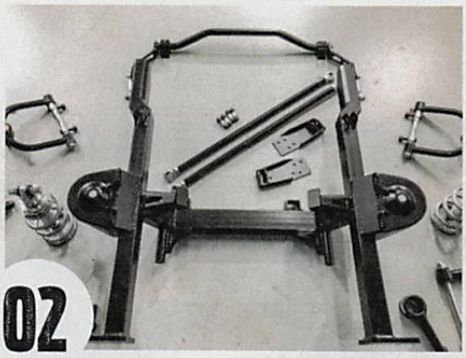
Scott Shop Towels; Kimberly-Clark Brands; scottbrand.com

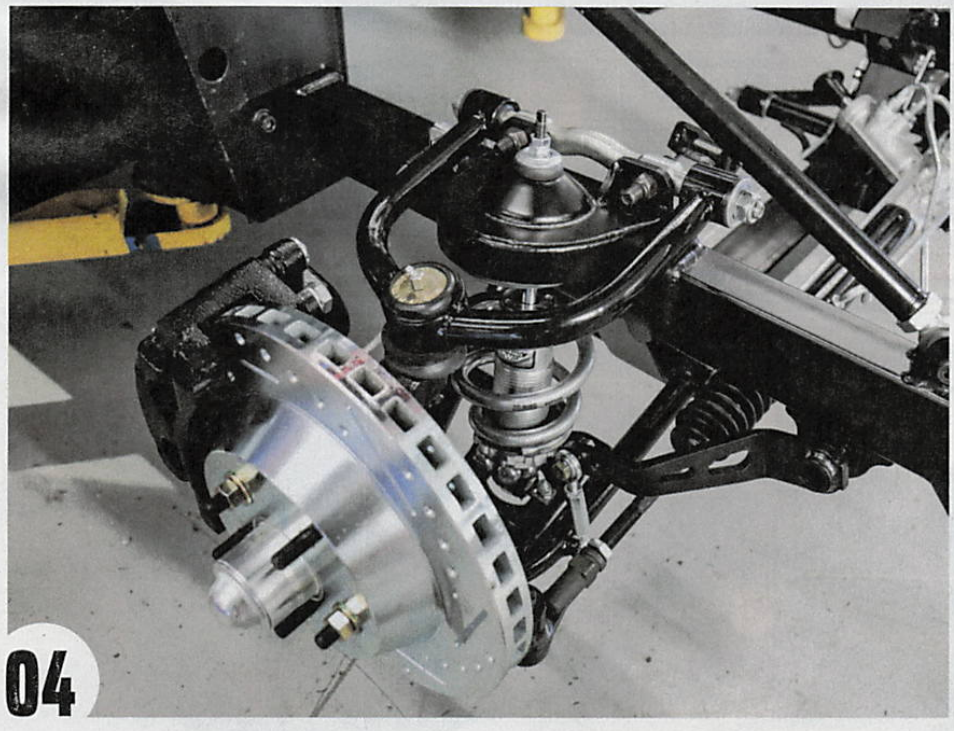
Spec Clutch; 800.828.4379; specclutch.com

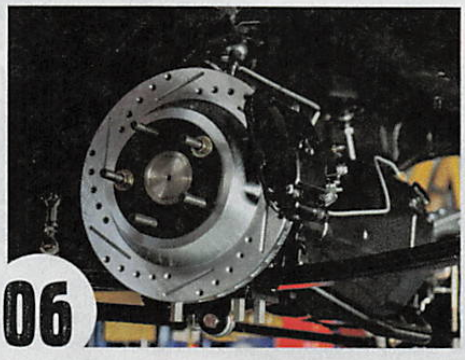
Tremec; 800.401.9866; tremec.com

United Pacific Industries; 866.327.5288; upauto.com

Viking Performance; 952.469.4130; vi-king.com







01 Every build starts somewhere, and day one consisted of disassembling the car, removing the front subframe and rear axle, and installing the new suspension components from CPP.

02 CPP's front subframe is much more stout than the Nova's sheetmetal front end. It has provisions for small-block and big-block Chevy engines, plus an LS will fit with adapter plates. Tubular upper and lower A-arms offer better handling than stock, and the kit also converts to a modern rack-and-pinion steering system.

03 Viking coilover shocks will allow us to dial in the perfect ride height. Clicking through the double adjustable shocks will set us up with the perfect ride characteristics.

04 MotorTrend tech center guys Jason Scudellari and Christian Arriero had the Nova's front end assembled in no time, thanks to help from CPP's Danny Nix and Luis Fernandez. The down-bars attach to the firewall for added support, and you can see the steering system and sway bar in place. Duralast provided the brake calipers and rotors as well as the tie rod ends.

05 The rear suspension saw major changes, as well. The puny rear axle was replaced with a beefy sheetmetal 9-inch from CPP. The leaf-spring architecture was maintained, but these are new springs from CPP, assisted by a pair of traction bars to prevent spring wrap. Note also the subframe connectors, sway bar, and adjustable Viking shocks.

06 A rear brake upgrade consists of calipers and rotors from Duralast mounted on CPP's disc brake conversion brackets. An E-Stopp electronic parking brake eliminates the old cable-actuated system.

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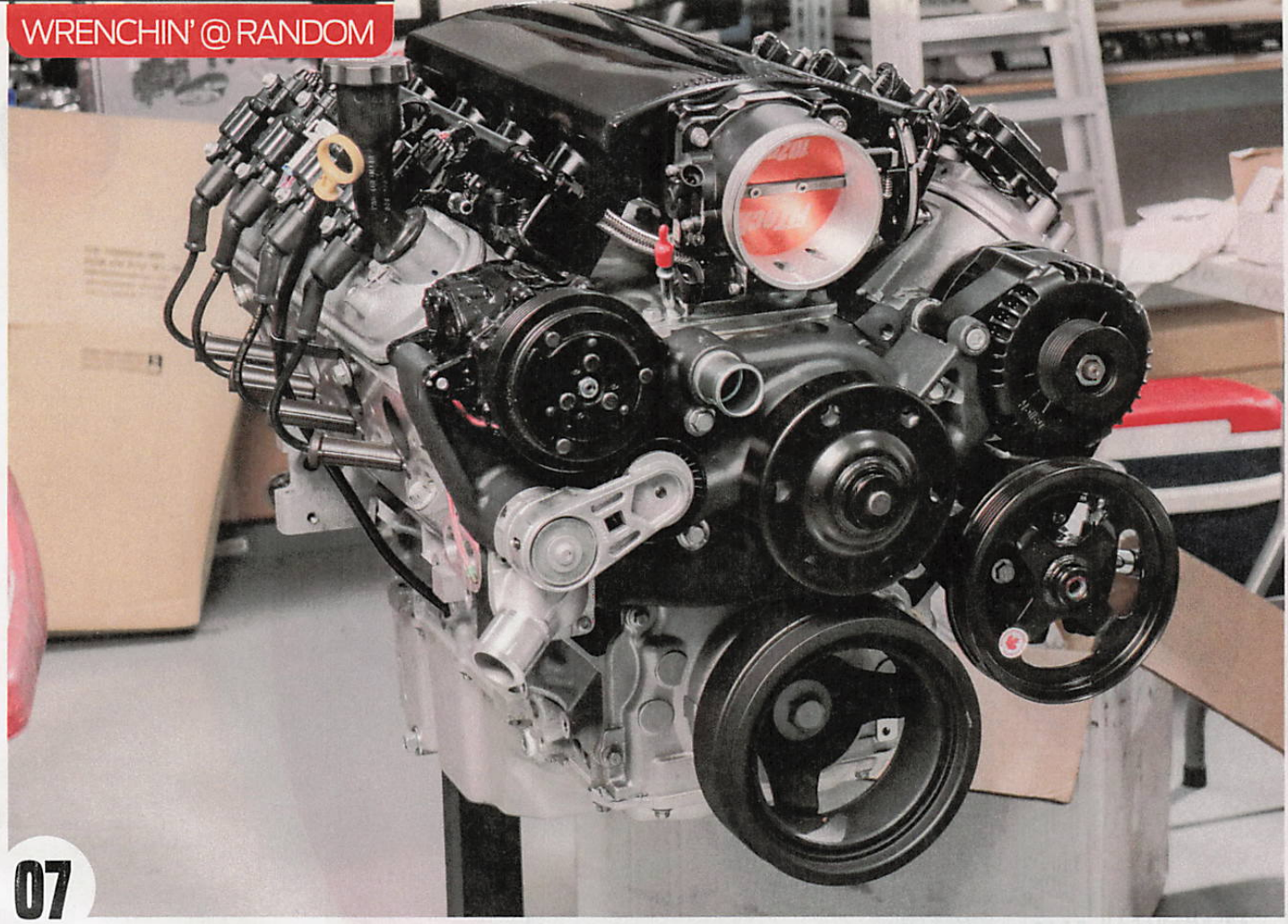

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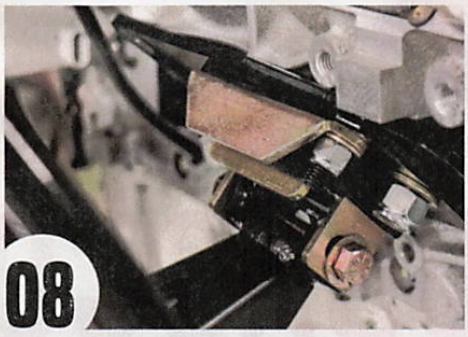

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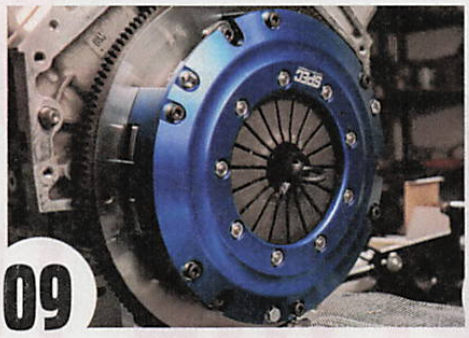

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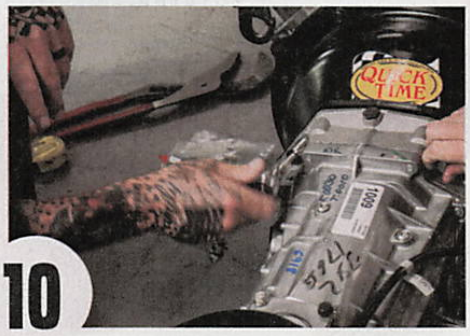

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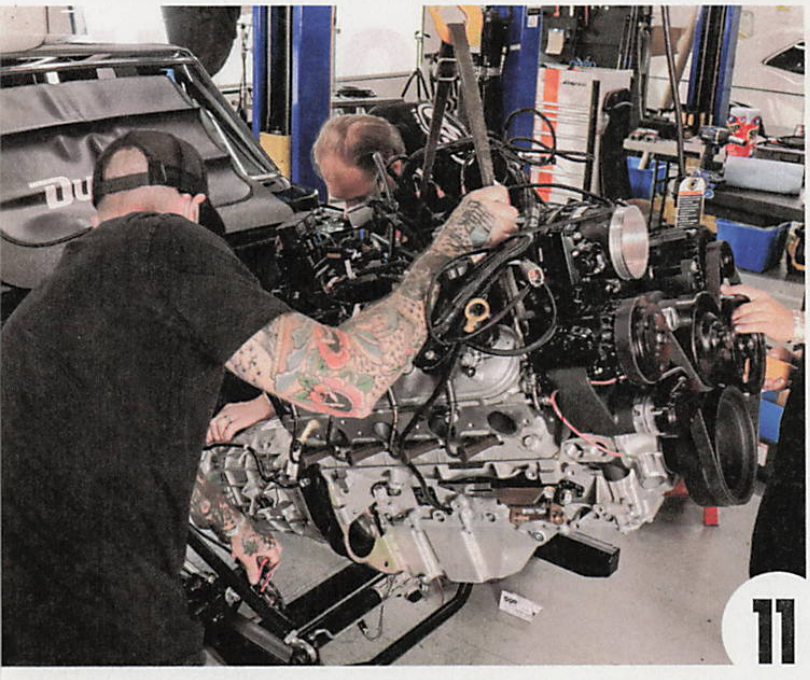

11

07 For power, we dialed up our local AutoZone retailer for a remanufactured 6.2L LS3 engine. Have no fear of this reman—it's built by Dahmer Powertrain and comes with a three-year/100,000-mile warranty. We put the engine through its paces at Westech Performance prior to the start of our build. On the dyno, this all-aluminum 6.2L engine made 490 hp and 430 lb-ft of torque, and pulled hard to 6,900 rpm with FiTech's Ultimate LS port-fuel injection system for LS3 and L92 engines.

08 We used CPP's Fit Rite adjustable motor mounts, which allow the engine to be slid fore and aft for precise placement within the engine compartment.

09 SPEC contributed a flywheel and dual disc clutch assembly to the cause. Perhaps a little overkill right now, the dual disc setup will be handy should a power adder be employed at some time in the Nova's future.

10 Backing our LS3 is a Tremec T56 Magnum six-speed transmission from Bowler Performance Transmissions. Quick Time Performance provided the SFI-approved bellhousing located in between.

11 With the front-end sheetmetal removed, increased access to the engine compartment makes it much easier to drop the engine and transmission into place.

12 Like their FitRite motor mounts, CPP's transmission crossmember and mount adjusts fore and aft to match the placement of the engine in the chassis. Note how it ties into the subframe connectors for extra chassis rigidity.

12

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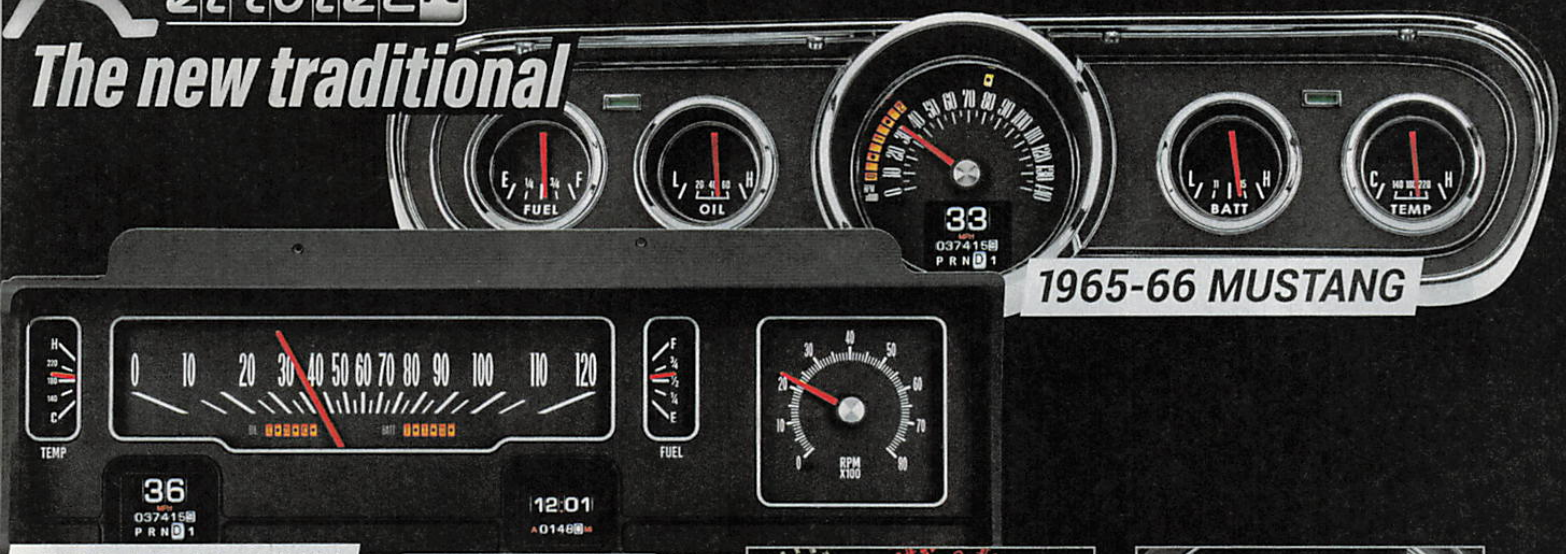

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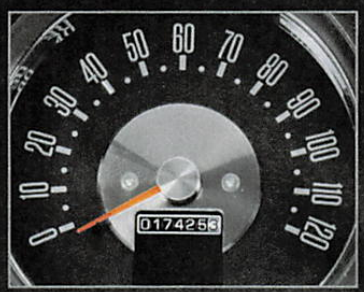

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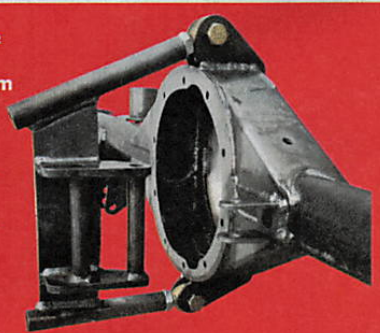

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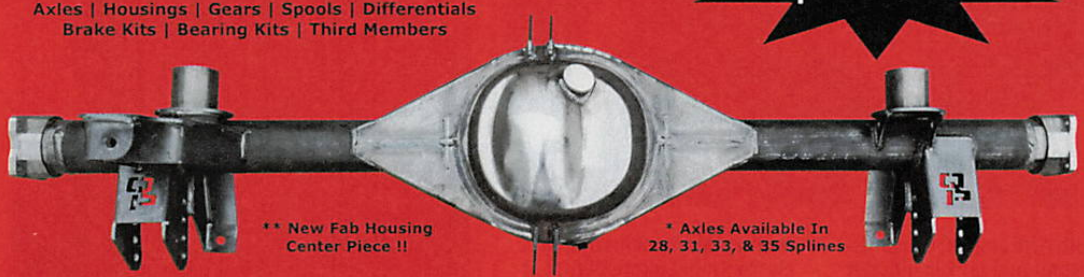

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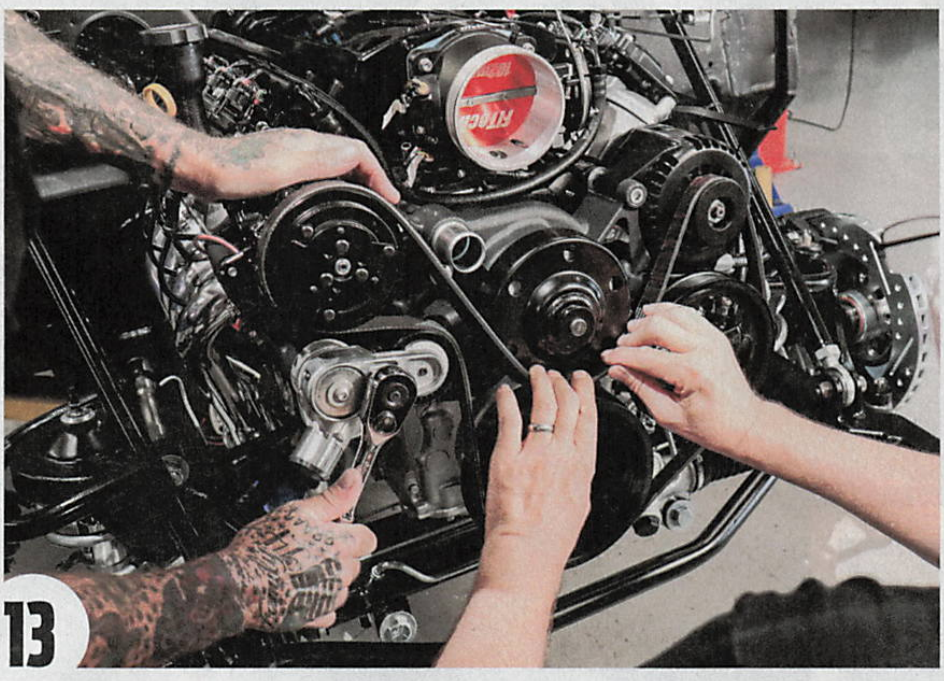
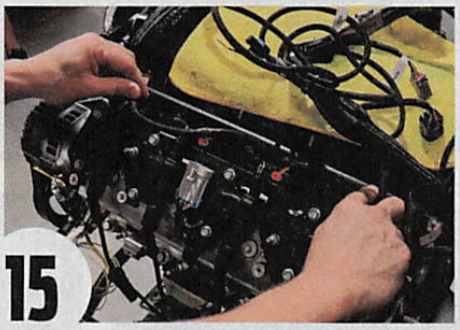
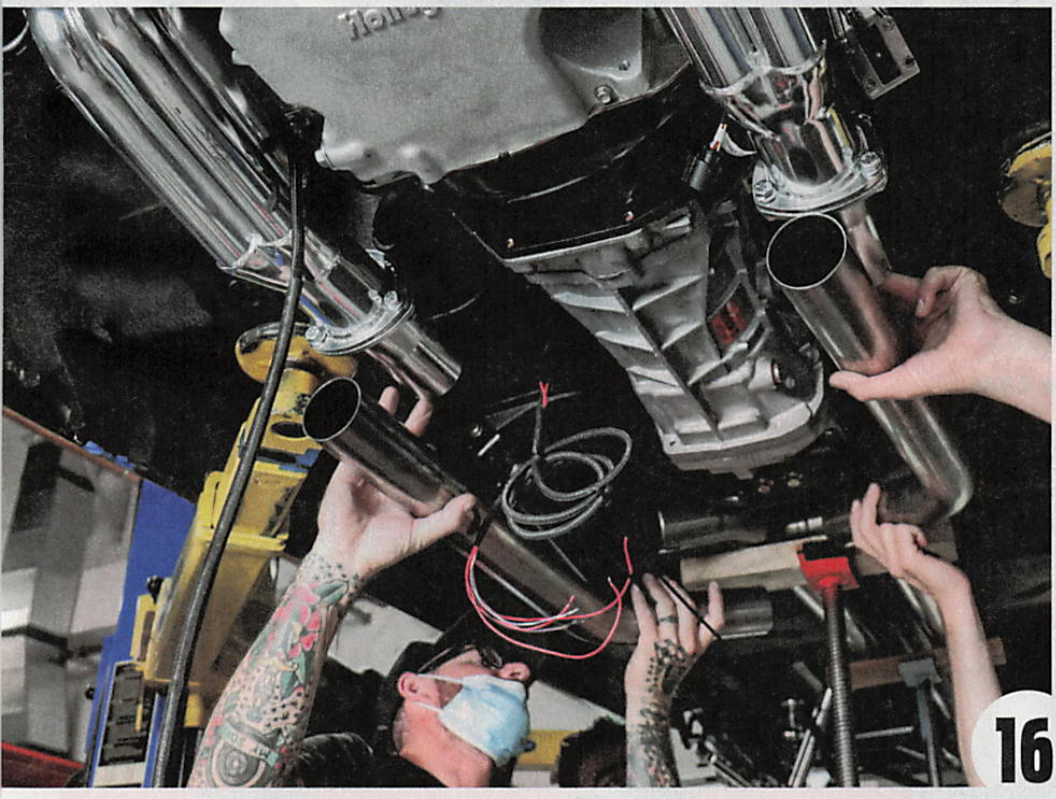
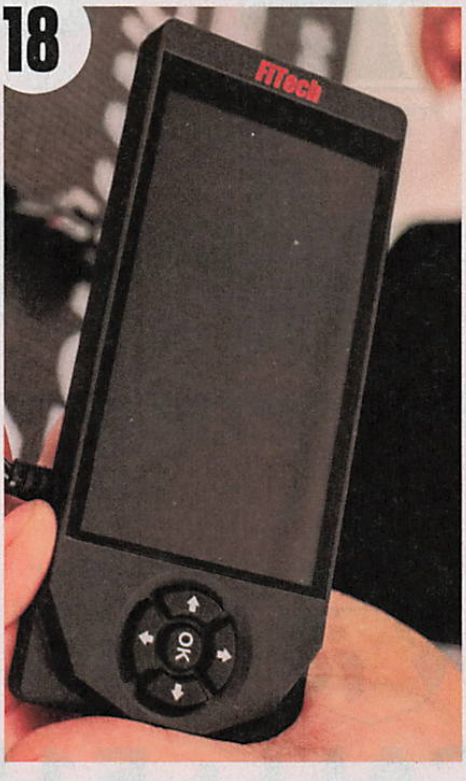








13 We used Holley's innovative water pump and engine accessory drive kit that mounts the alternator, power steering pump, and A/C compressor all directly to the water pump casting for a tight, compact fit. We used a Duralast power steering pump with a remote reservoir for extra clearance.

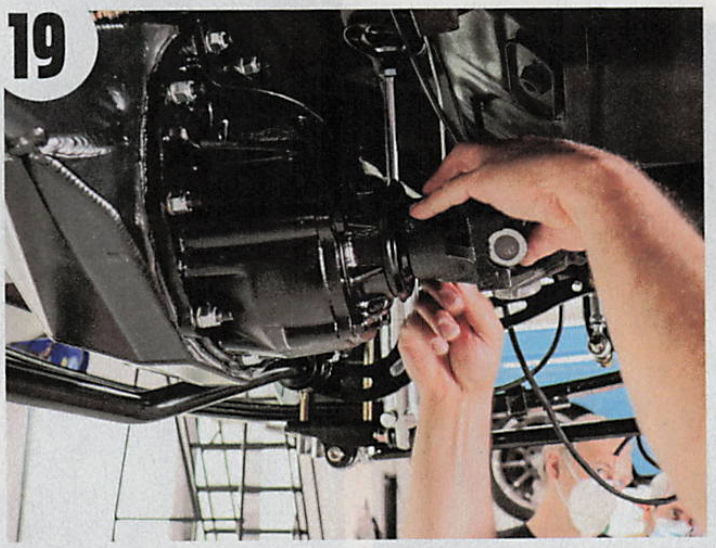
14 CPP's aluminum gas tank is EFI-ready with internal baffles and contains a 340-lph in-tank fuel pump, sending unit, fuel filter regulator, rubber lines, and fittings.

15 With the engine, transmission, and fuel tank in place, it was time to begin plumbing and wiring those components. FiTech's EFI system includes the ECM and easy-to-connect wiring harness.

16 Holley provided plumbing of a different sort, in the form of a header-back exhaust system to connect with CPP's long-tube headers.

17 Inside the car, the guys were busy buttoning up the fuel and dash harness, plus hooking up the shifter and installing the new replacement instrument cluster from Dakota Digital. It communicates with FiTech's ECM for vital engine temperature and pressure information, and the GPS-based speedometer provides an accurate, reliable reading.

18 We also found a place to mount FiTech's handheld ECM interface. Though the system is largely self-learning, its setup is done through this display. Minor tuning changes can be made while the engine is running, too.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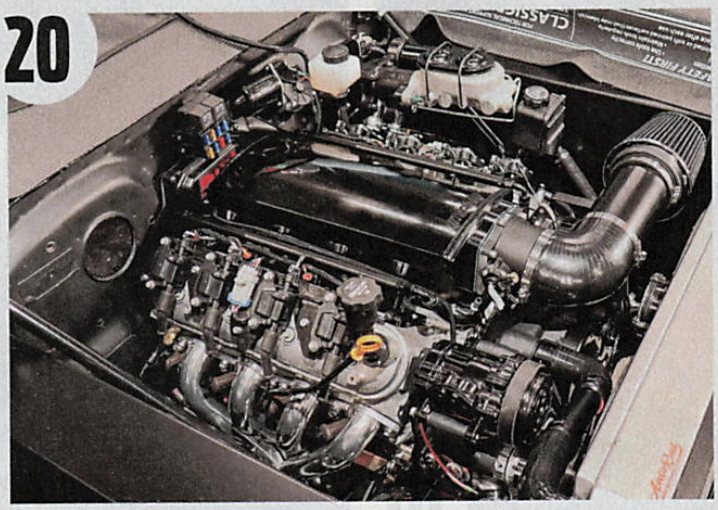
19 A local shop built a custom driveshaft for us based on our measurements. With it installed, we were that much closer to this Nova moving under its own power.

20 Nearly done, we installed the core support and front sheetmetal. The AutoRad radiator and electric fans will keep coolant temps in check, and that's CPP's universal air inlet for LS engines. CPP also provided the Hydroboost brake master cylinder.

21 Topped with fluids, the engine fired and ran right away, so it was safe to put the hood back on and call this build done. Check out the Cruiser wheels from American Legend Wheels. We wrapped them in a set of sticky Falken Azenis RT660 tires.

22-23-24 Now all that was left to do was the traditional Week to Wicked burnout, a very satisfying way to end what can be a stressful weeklong build. To say tech center manager Jason Scudellari enjoys this task is an understatement. We also took the Nova for a spin around the shop and are pleased to report that all systems were working as they should. Check out the cool LED taillights from United Pacific and the killer stance, thanks to the CPP suspension and the wheel and tire combination. In all, we achieved our goal, making this Nova a modern, comfortable, reliable driver with plenty of power to melt those Falken tires at will. Like this build? Check out our expanded coverage and daily videos online at HOTROD.com.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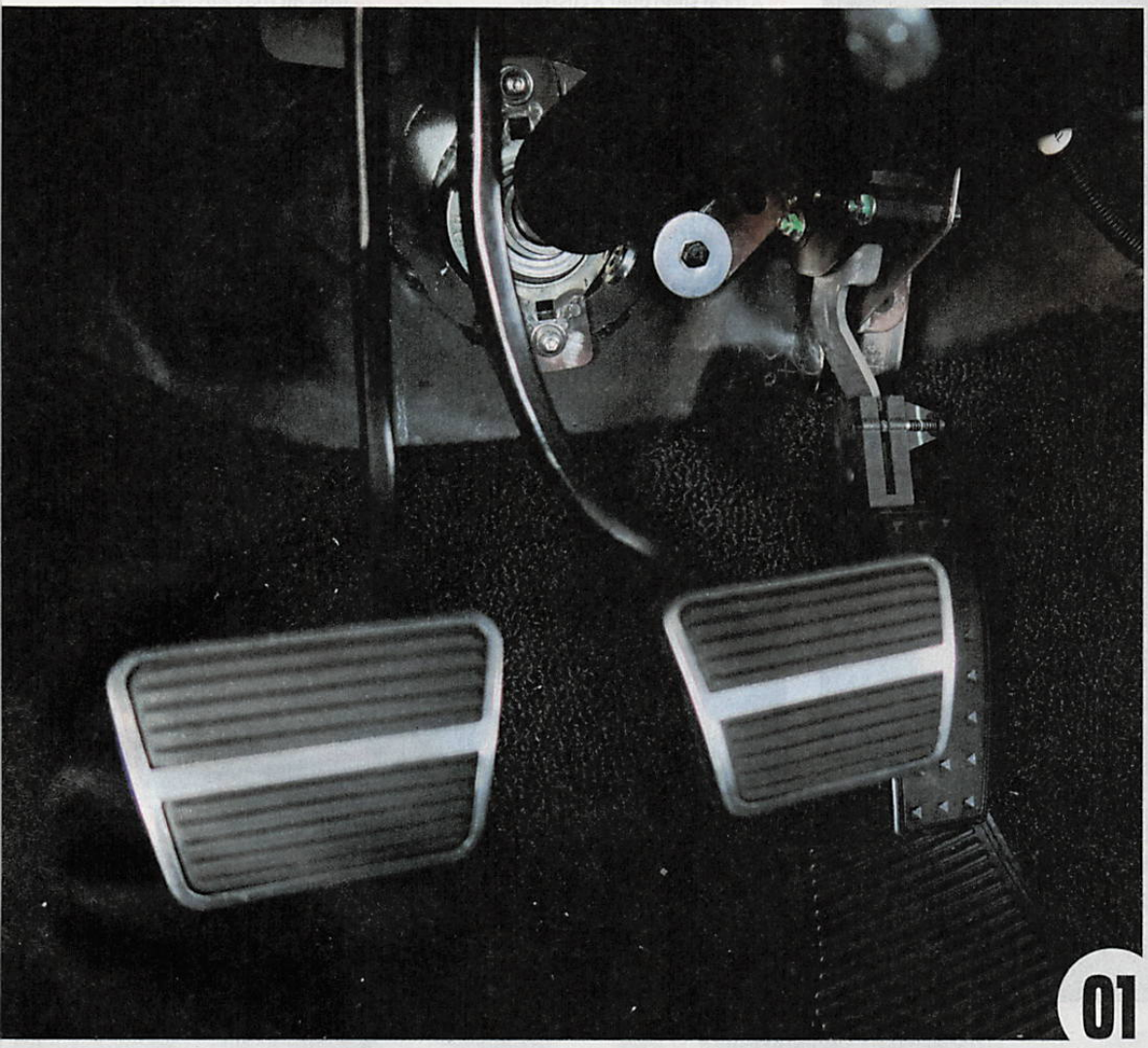

01

INSTALLING AFTERMARKET PEDALS AND DETERMINING THE CORRECT RATIO.

Steven Rupp

Our classics are typically a balancing act between form and function, and though many factory parts work just fine in our modified cars, sometimes we crave something that just, to be blunt, looks better. Pedals and pedal covers would fall into this category, and for the most part, fall under want way more than need. Although installing aftermarket pedals is an aesthetic choice, there's also some science involved with determining the correct pedal ratio.

As stated, there's nothing wrong with the functionality of the factory pedals, but if you've updated the look of your interior, they can appear a bit dated. Also, because our Camaro has an electronic throttle pedal (LS Swap) the pedals match in terms of style. One functional issue we did have was that the throttle pedal was positioned so much lower than the brake pedal, and this was a great opportunity to fix that.

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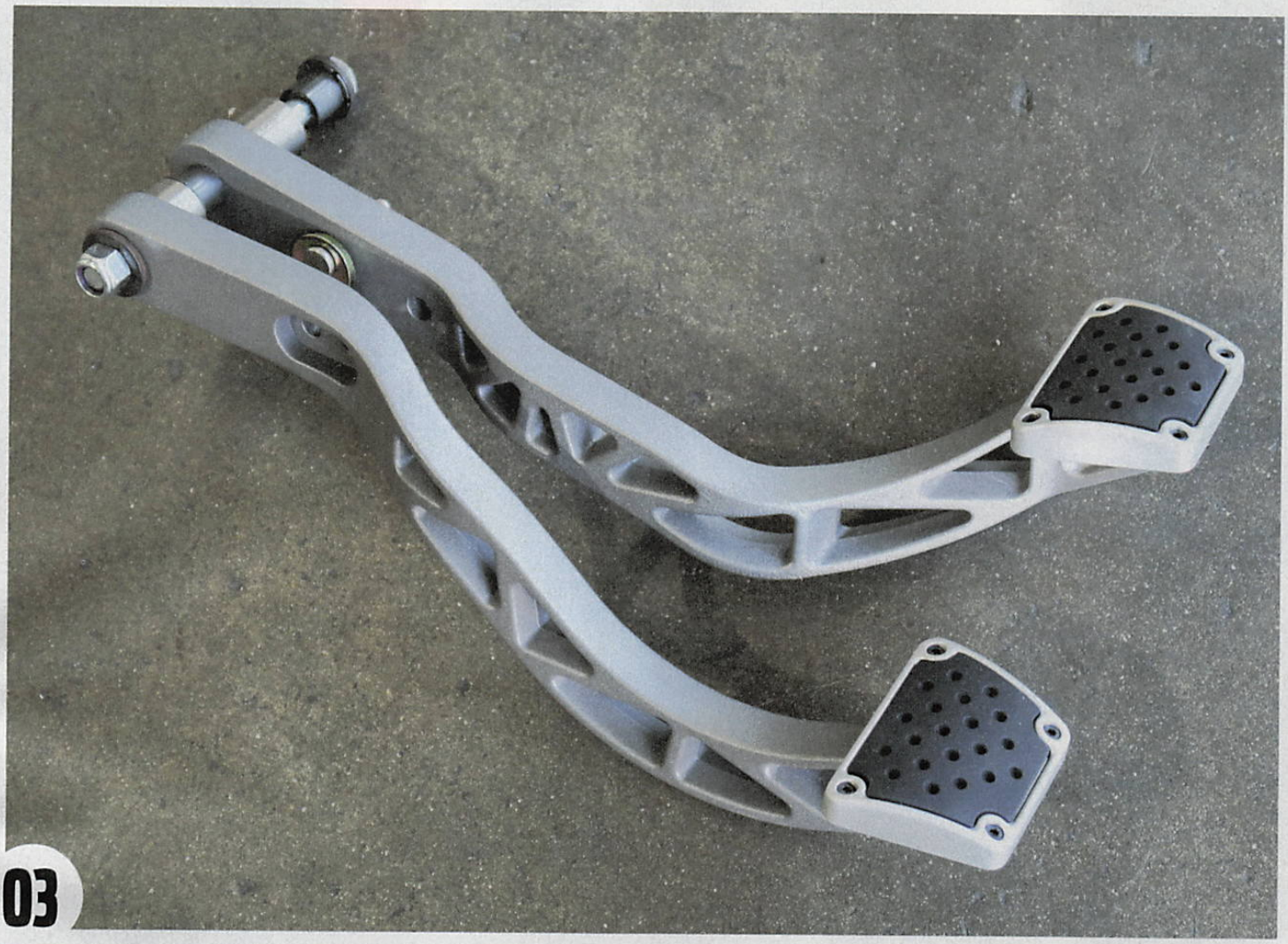

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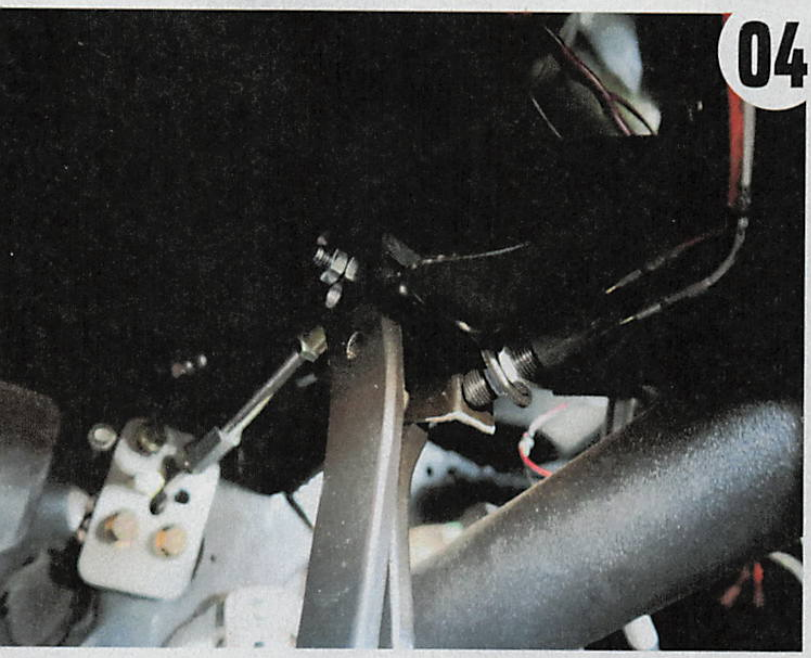

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05

03 Clayton Machine Works offers an aluminum replacement pedal assembly that bolts in place of the stock setup. Our car has a manual transmission, so the pedals are bound as a pair for the brake and clutch. You can also get the kit for an automatic, which would have one swing arm and a wider pad.

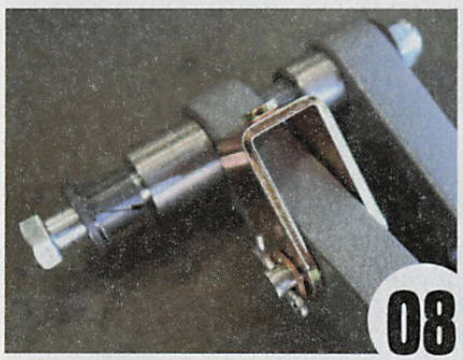
04 The pair of stock pedals hang on a large factory bracket under the dash. To start, we disconnected the rods connecting the pedal arms to the clutch and brake masters. We then unbolted the swing arms from the dash bracket.

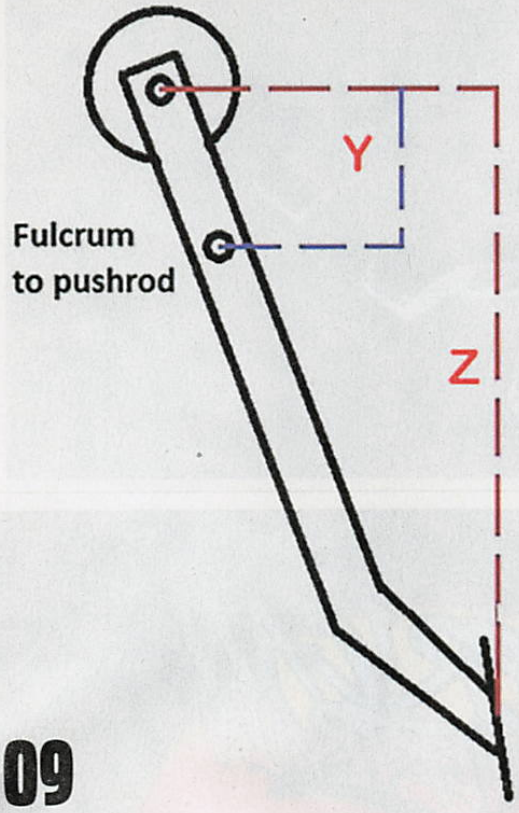
05 Once our factory pedals were out of the car, we were able to compare them to the new pieces from Clayton. Although similar in shape, the Clayton pedals have a decidedly modern look. These pedals work on several different cars (Camaros, Chevelles, etc.) and are configured for each car by changing the bushing and spacers where the two pedals join and pivot.

06 On the clutch arm, there were two holes to choose from to get the right ratio (angle) on the clutch master pushrod. Right angle? Yep, like everything in life there's a right and a wrong. For hydraulic clutch systems, you want to get a 6:1 ratio (provided your clutch master is 7/8-inch bore or smaller). If this ratio is wrong, the pedal will be hard to operate. If it's really wrong, you can damage the clutch master through too much side loading. So, with some math you can find the right spot to attach the clutch rod to the pedal arm. You can see where we had to drill holes in the stock pedal arm to get the right ratio. In many cases, it will be one of the two holes provided in the Clayton arm.

07 But not always. You need two measurements: the length from the pivot/fulcrum of the new pedal to the pushrod hole (Y) and from the fulcrum to the center of the brake pedal (Z). This formula ends up being Y/Z = ratio. So, if your pedal is 12 inches long (Z) and the pickup point is 4 inches from the center of fulcrum, then your ratio (12/4) is 3:1. Given this, you'll need to add a hole to get the right ratio for your application. A pickup point 2 inches from the fulcrum would yield the desired 6:1 ratio. If your clutch master is larger than 7/8-inch bore, you will need to do a little research to find the optimal ratio. Also note that if the angle to get the right ratio is too sharp there will be bind. The only way to fix the bind is to move the clutch master or check out the adjustable clutch master firewall mount from American Powertrain that lets you dial in the angle of the clutch master in relation to the firewall.

08 The brake pedal attaches to the brake master pushrod via this clevis. There are two holes on the brake pedal arm: an upper hole for manual brakes and a lower hole for power brakes. You can use the same math to check your ratio here as well. For power brakes, you want a ratio between 4:1 and 5:1. For manual brakes, you want a ratio between 5:1 and 7:1. Our car has manual brakes, so we used the upper hole.



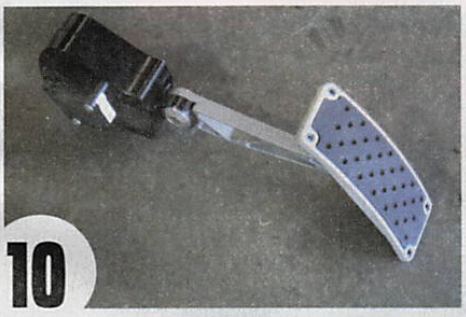


09

09 For those who think visually, this should clear up how you determine your pedal ratio, and this diagram works for the brake as well as the clutch pedals.

10 Although Clayton does offer a traditional cable-actuated throttle pedal, our car has an electronic throttle body. As luck would have it, Clayton had us covered here as well. Before ordering this, we would advise a call to Clayton to confirm your application, ECU, and what pedal your system requires because this isn't as universal as a cable system.

11 The key part is the Accelerator Pedal Position Sensor (APPS). This has been calibrated by Clayton, so there's no need to mess with it. The biggest challenge with this pedal is mounting it to your firewall. We were ahead of the game here because we already had some structure in place to hold our existing GM pedal. The two rear holes are 3/8"-24, and the bolts are not included because the length will change based on how you mount it. The holes are 2.25 inches apart.



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11

12 The kit included this pigtail extension harness to plug into our existing GM harness. They also have a harness with butt connectors and wiring diagrams to interface with many popular ECUs from GM, Ford, and Mopar.

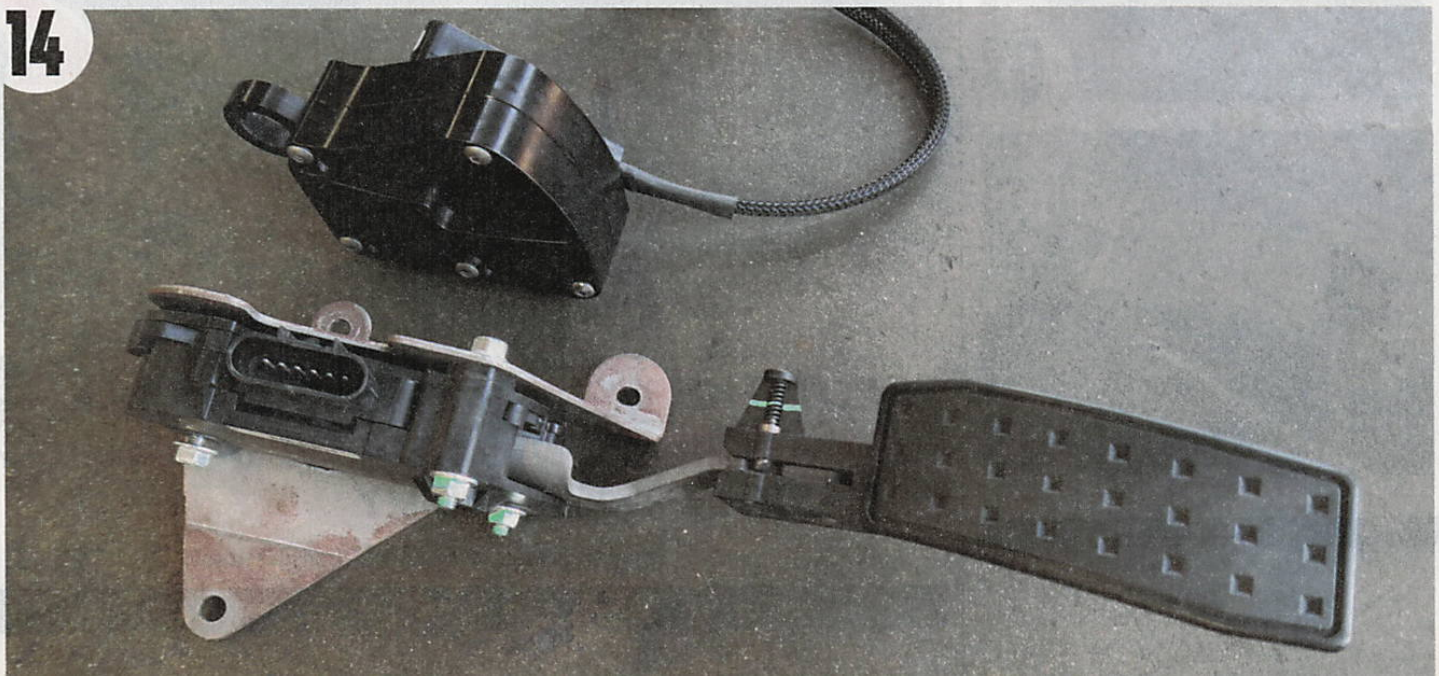
13 Even though you could bolt the throttle pedal directly to your firewall, we've found that the firewall is rarely flat where you want to mount the pedal. In our car, we had a fabbed-up brace for our GM pedal. Going this route let us easily put our pedal in the perfect location. When we're done, we really should paint this.

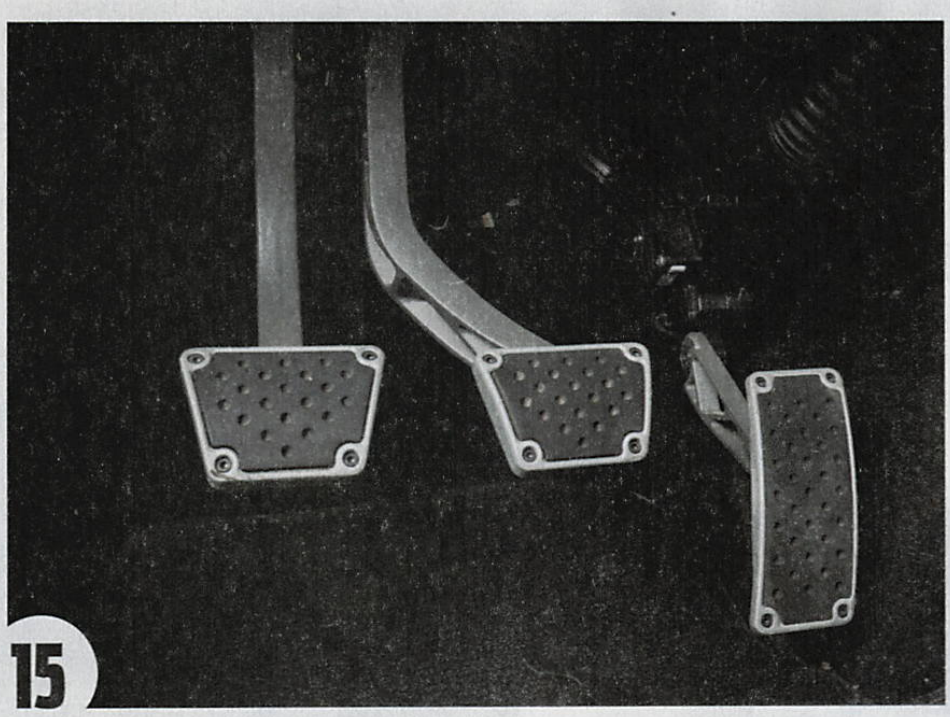
12

13

14 Here you can see our stock GM pedal next to the brains of our new Clayton pedal. We simply made a plate that matched up the three mounting points of our GM pedal, and then mounted the Clayton APPS right where we wanted it. Chances are your needs will be different in terms of how you mount it, so enjoy the fabrication process that is hot rodding.

14





15

15 After working with several brackets, we came up with one that not only secured the new throttle pedal to the firewall, but also let us move it forward to a spot in line with the brake pedal. Once all the pedals were installed, we simply had to recheck all the fasteners and adjust the brake light switch.

16 The new pedals are in and the modern design certainly fits better with our updated TMI interior. Between measuring ratios, fabbing APPS brackets, and dialing everything in, we spent the good part of a full day getting these installed correctly.

16

the D.U.I. report

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The Chevy D.U.I. Distributor was the first, and still is the best performance H.E.I. Distributor. Inferior copy cats have come and gone, but the D.U.I. remains the most popular choice for hot rodders around the globe. A super smooth advance curve is machine calibrated, providing you with instant throttle response, while eliminating engine damaging detonation. The 50,000 Volt D.U.I. Coil teams up with our high dwell Dyna-Module, allowing you to run a massive .055" plug gap. 8, 6, & 4 cyl. applications are available.

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Does Your Mopar Need Bigger Brakes? Big Power Says Yes, You Do!

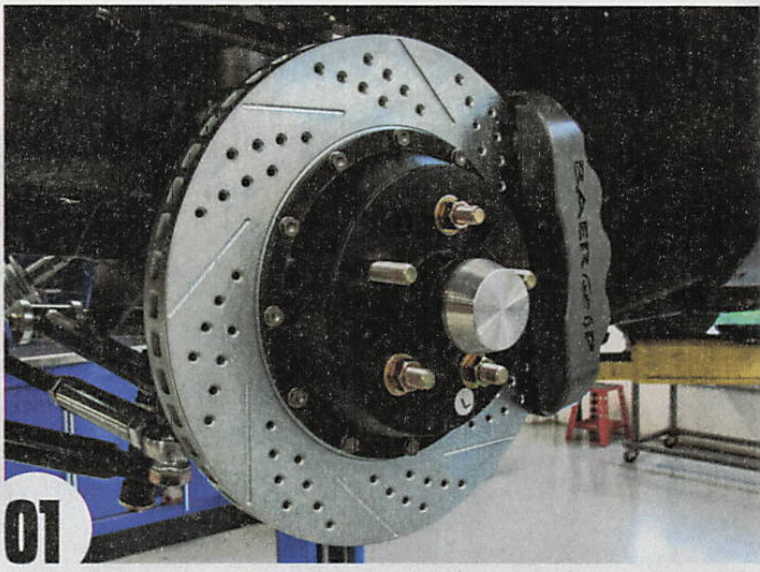
Johnny Hunkins Christian Arriero

With the gentrification of old cars that began in the 1980s and continues today, many vehicles that were considered junk before are now—because of their affordability—are seeing the performance spotlight. So, while one might expect a 1970 'Cuda to be a good candidate for a disc brake upgrade, it might not be so obvious for a more utilitarian car like a same-year, Slant Six Duster.

Does your Mopar need a complete four-wheel disc brake conversion? That depends. For those who prize originality or rarity, an expensive disc brake conversion or upgrade package may have the effect of lowering the value of a car. That said, restoring a vintage brake system to acceptable operation with all NOS parts may not be easy, cheap, or fun. And even if you don't mind the hassle of restoring vintage brakes, it's likely you will not enjoy their performance. This route is clearly for the prized classic that is seldom driven, and even then, don't expect it to stop as quickly as the beater Toyota in your driveway.

Just up the ladder from stock brakes are more modestly priced disc brake conversions with calipers having one or two pistons. Besides doing a better job stopping than drums, discs effectively even out the imbalance between the left and right sides. People who swap from drums to discs almost unanimously report straighter braking performance, a big confidence booster.

While there are many companies that offer entry-level disc brake conversions, often kitted together from proven OE parts, a much smaller cadre of companies offer what can be described as maximum-effort street systems and pro-level race setups. Costing thousands of dollars, they represent a big investment in any ride, and in occupant safety. Baer Racing has been building these kinds of brake kits for 30 years and has

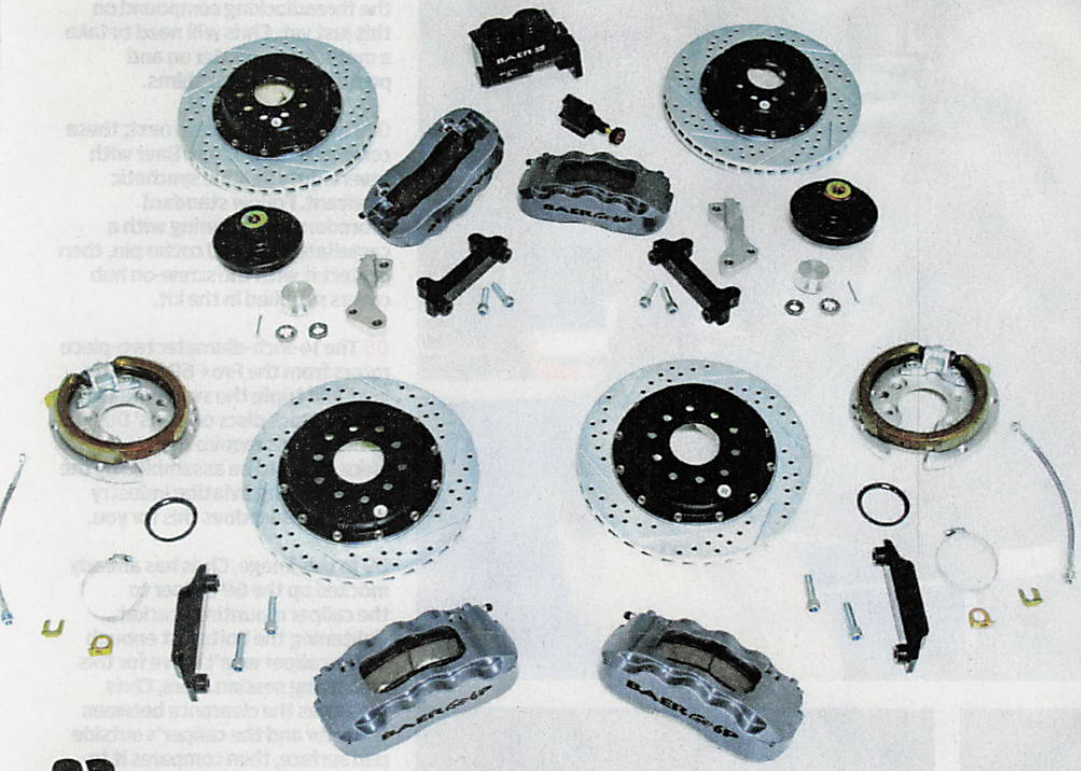


01 Baer's Pro+ 6P kit, shown installed on the front of Christian Arriero's 1974 Plymouth Duster.

Sources

Baer; 602.233.1411; baer.com

Weld Wheels; 800.788.9353; weldwheels.com



02

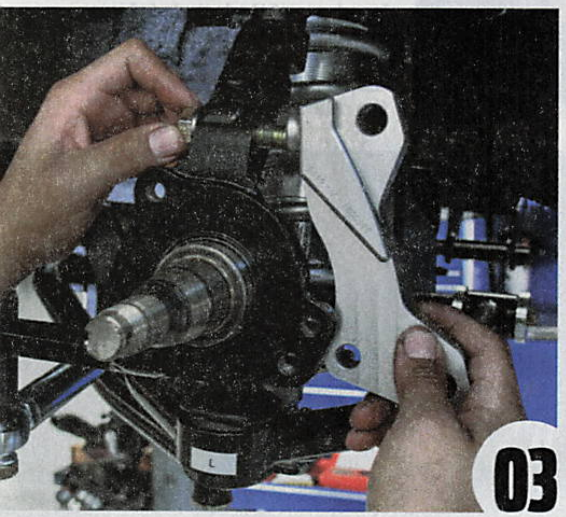
02 Baer's 6P brake systems fall in the middle of offerings by the company, and both the front and rear kits are represented in this photo. All Baer's kit components are made in-house at the company's Phoenix, Arizona headquarters, or are sourced within the USA. We've installed Baer kits before, and we like how everything is included in the kit, right down to the last fastener.

At a Glance: 1974 Plymouth Duster Brake System

- Baer Remaster master cylinder (part No. 6801298RP, $395)—Direct-fit replacement for the stock Mopar master cylinder, available in 15/16-, 1-, and 1 1/8-inch bore diameters. Chris' car has a 15/16-inch-diameter unit for unassisted manual brakes.

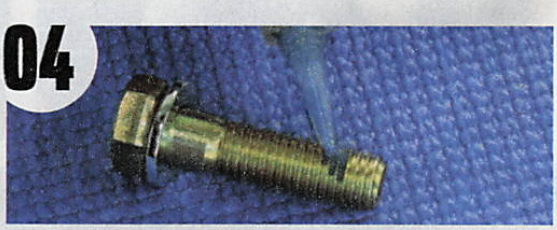
- Baer 14-inch Pro+ 6P front brake system (part No. 4261270, $2,445)—Six-piston, 6P calipers with 14-inch, two-piece, slotted, drilled, zinc-plated rotors. D.O.T-compliant dust and weather seals and uses the common D0731-type pad. Includes billet aluminum hubs with prepacked premium bearings and synthetic lube. Will fit inside Chris' front 18x10-inch Weld wheels.

- Baer 13-inch Pro+ 6P rear brake system (part No. 4262149, $2,395)—Six-piston calipers with 13-inch, two-piece slotted, drilled, zinc-plated rotors. Same 6P calipers as front system. All 6P rotors are preassembled with NAS high-grade stainless hardware. Unique backing plate acts as a caliper mount and also houses a one-piece park brake shoe assembly. Stainless braided hoses are also included. Easily fits inside Chris' rear 18x11.5-inch Weld wheels.



03

03 At first, it may be hard to recognize what's part of the Baer 6P kit, and what is part of the Reilly Motorsports AlterKtion coilover previously installed. The spindle shown is from RMS and is based on a Mustang II design. (For this reason, the kit part number shown in this story is different than one for a Mopar A-Body with a true Chrysler spindle.) For this kit, there are two caliper brackets, one to mate to the Mustang II spindle (*shown*), and one to mount the caliper to this innermost bracket. Why this is the case will become apparent shortly.



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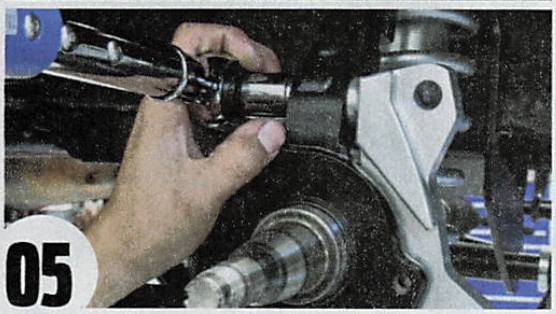


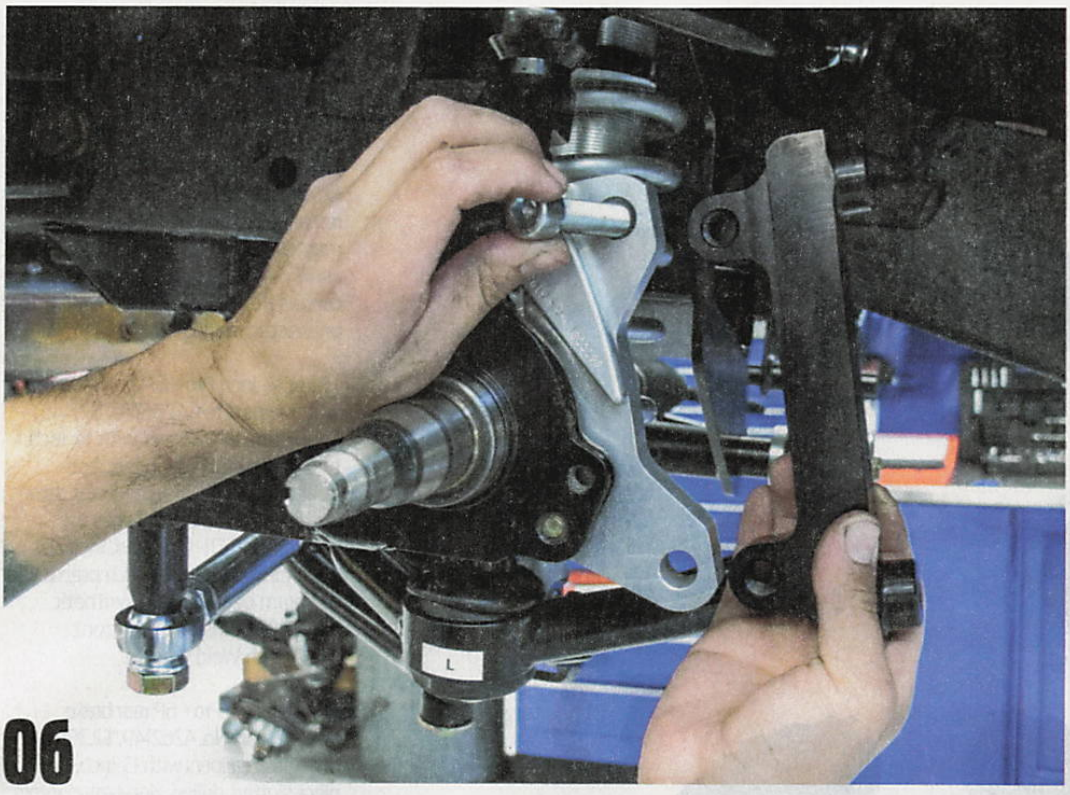
05

04-05 It's critical for the included bracket mounting bolts to get a dose of blue Permatex Threadlocker. These get torqued to 70 ft-lb.

amassed a reputation for offering disc brake upgrade systems for many makes, many years, and many purposes.

Smack-dab in the middle of Baer's range of systems is the company's 6P lineup. Designed to take what the most potent street cars can dish out, the Pro+ 6P offers either 13- or 14-inch two-piece slotted and drilled rotors with the company's proprietary six-piston, two-piece calipers. It's essentially the less expensive little brother to Baer's Extreme 6S system, but with slightly smaller, more widely available Corvette C5-based pads. For the active enthusiast who brings his machine to compete in autocross or open track days, the 6P system is ideally positioned to provide an excellent balance of cost and performance. This is the reason the 6P system was selected by MotorTrend's Tech Center technician Christian Arriero for his 1974 Plymouth Duster.

In the case of Chris' 1974 Duster, power has increased by a factor of four, going from a stock Slant Six to a built Magnum 360 making nearly 500 hp. Throw in much larger tires with some real ability to grip the road, and those production brake linings, rotors, and rear drums would've gone up in flames after a single autocross lap—forget about lapping a truly fast local track like Willow Springs. With the addition of Baer's complete 6P system for the Mopar A-Body (or in our case, a Mustang II-type spindle on a Mopar A-Body), concerns about overheated brakes, missed apexes, and unplanned off-road excursions won't be an issue. One thing is for sure: If Chris does have a mishap at the autocross or road course, it won't be because his brakes weren't up to snuff!



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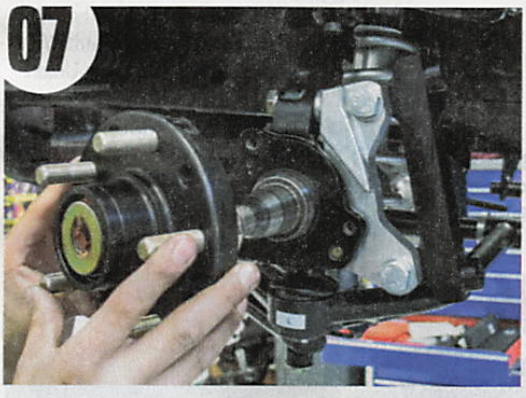

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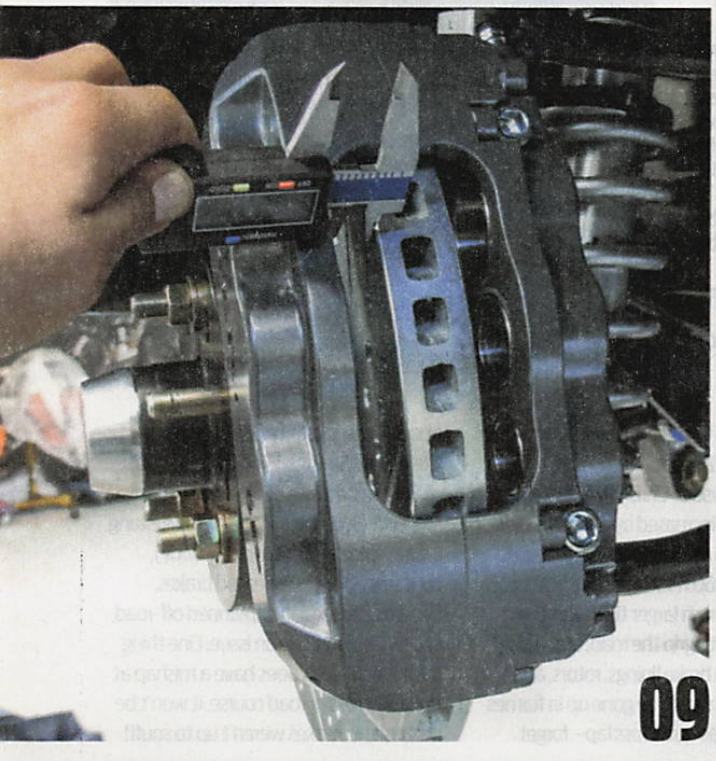

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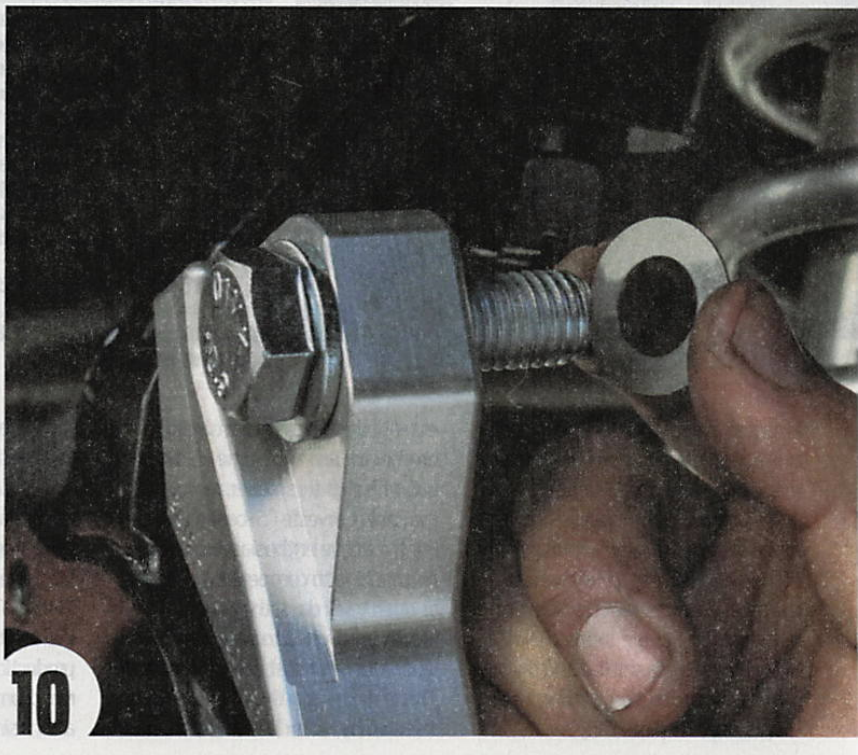

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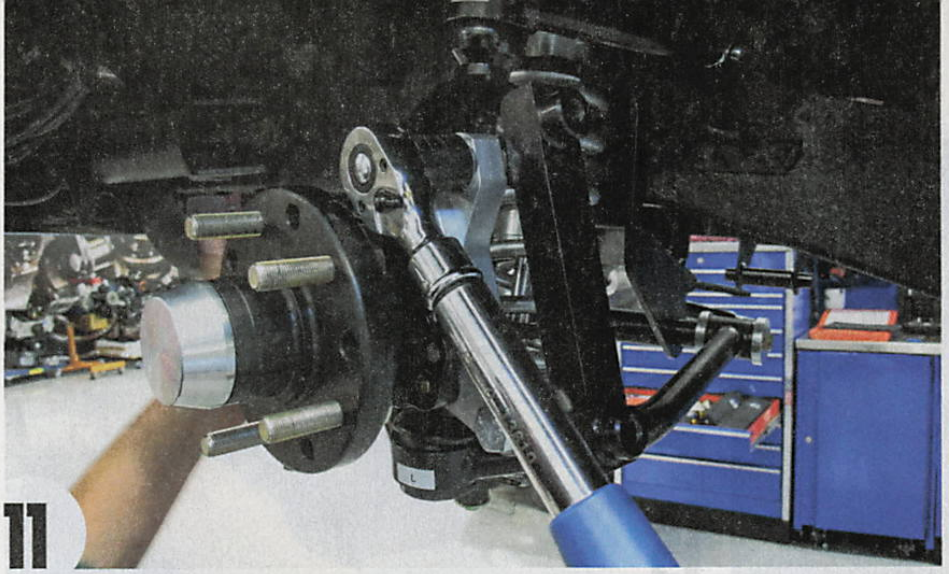
06 This anodized steel caliper bracket is attached to the spindle bracket using the included fasteners. You don't want to use the threadlocking compound on this just yet. Chris will need to take a measurement later on and possibly add spacer shims.

07 The Baer hubs go on next; these come assembled from Baer with severe-duty Redline synthetic lubricant. Follow standard procedure for capturing with a castellated nut and cotter pin, then protect it with the screw-on hub covers supplied in the kit.

08 The 14-inch-diameter two-piece rotors from the Pro+ 6P kit go on next and triple the swept area of the old stock discs on Chris' Duster. Some brands require their two-piece rotors to be assembled by the installer using aviation industry tools, but Baer does this for you.

09 In this image, Chris has already mocked up the 6P caliper to the caliper mounting bracket, tightening the bolts just enough so the caliper won't move for this measuring session. Here, Chris measures the clearance between the rotor and the caliper's outside pad surface, then compares it to the same clearance on the inside. The measurements are rarely the same, but they need to get as close as possible so that the pad wear is consistent.

10 With the rotor, caliper, and caliper bracket removed, Chris will insert one of the included shims in the Baer kit to each of the two mounting bolts. This will pull the caliper inboard slightly, centering the caliper over the rotor.



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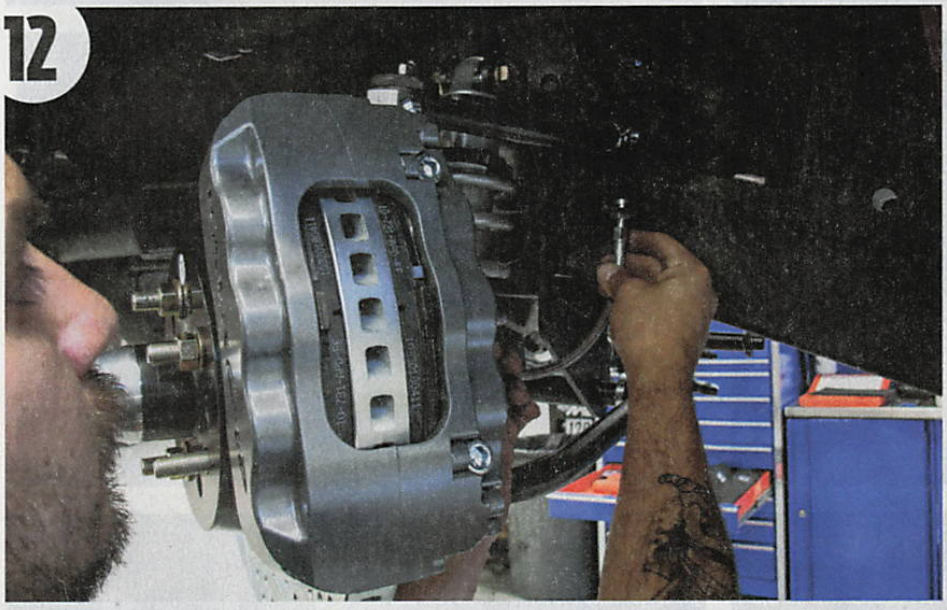

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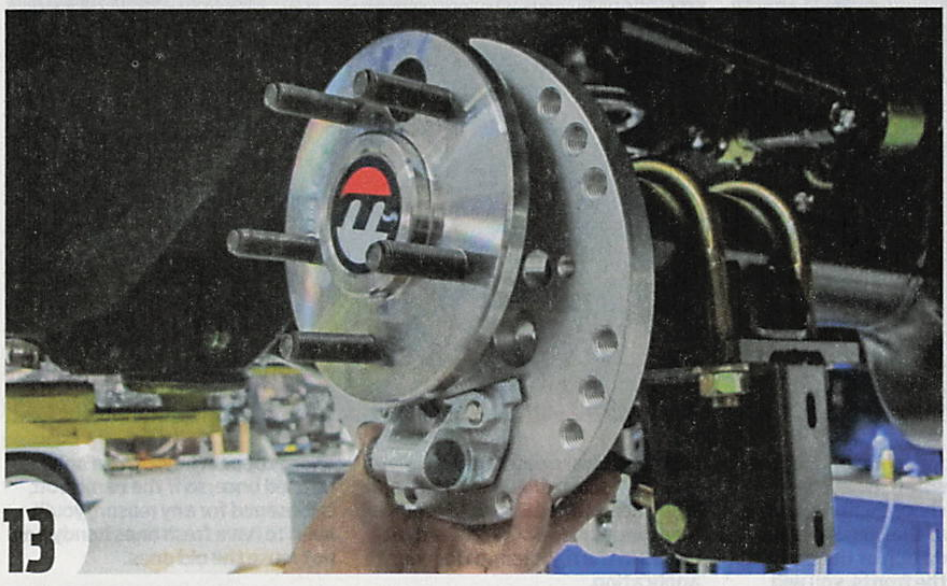

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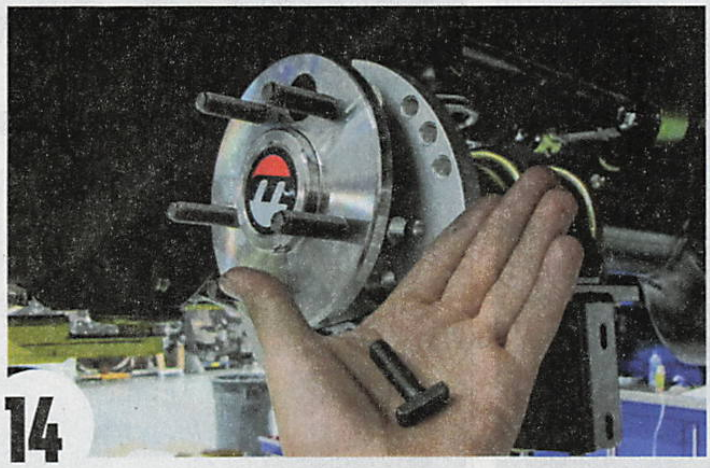
11 With the shims in place, Chris reassembles the corner, this time using threadlocker, and torquing everything to Baer's final spec.

12 There are two important safety measures about Baer kits we need to mention: Baer uses only Teflon-lined braided stainless steel hoses for their kits. Unlike stock rubber hoses, they don't have any give when subject to hydraulic pressure (as manifested by a soft pedal), and they don't deteriorate and dry out with age or chemical exposure. The second thing is that Baer only uses copper crush washers and banjo fittings for caliper junctions. This provides a safer, superior seal that won't leak over time.

13 Like the front, Chris' rear axle is more Ford-like than Mopar, with a Torino flange at the ends of his Ford 9-inch rear. The Baer Pro+ 6P rear kit features an integral parking brake drum that hides inside the rotor hat. You can see the parking brake piston on the bottom of the backing plate (*shown, in hand*), which gets mounted to the axle flange next.



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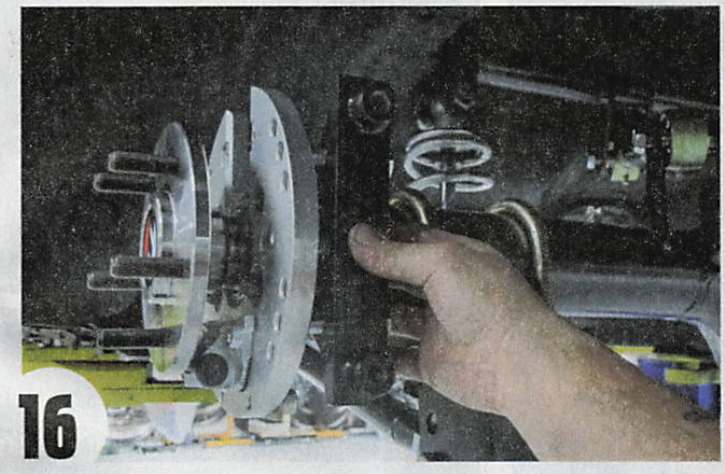

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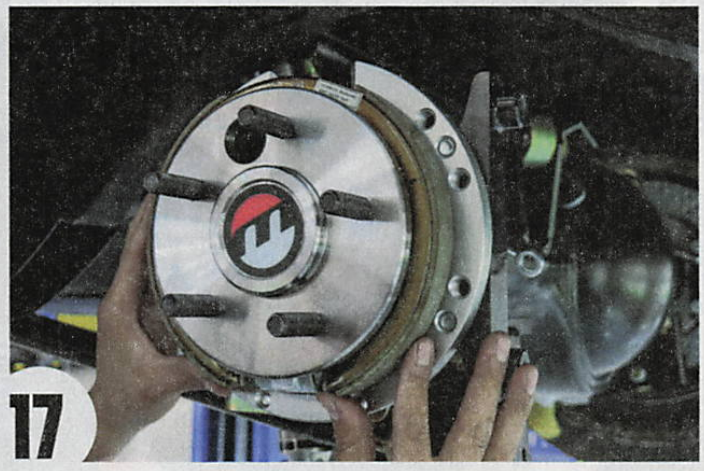

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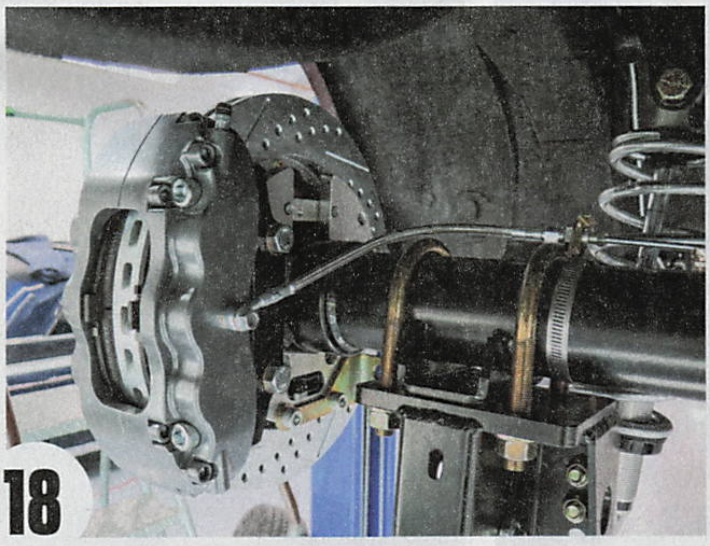

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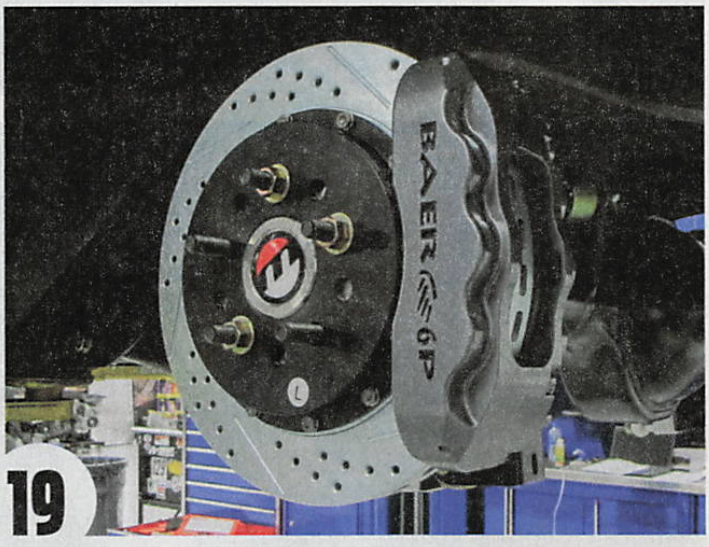

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14 Four T-bolts like this one are used to attach the brake mounting plate to the axle tube flange on the 9-inch rear axle. You'll use the large hole in the axle flange to access and torque the nuts to the four T-bolts.

15 The nuts are torqued to the four T-bolts with 16 lb-ft of torque. No threadlocking compound is needed with these self-locking nuts.

16 The caliper bracket goes on next with two bolts. Note that there are actually six positions the rear caliper can be mounted in—three in trailing position (*shown*) and three in leading position. Whatever position you choose will determine the position of the bleeder valve and the orientation of the brake line. As with the fronts, you will need to go through the same caliper-centering process and reassemble everything after the measurement and the insertion of any shims.

17 The internal parking brake shoe must be slipped over the axle and into its collar before the rotor is inserted over the parking drum. Because every car and system is different, Baer doesn't provide parking brake cables with its kits. You'll need to call Baer and provide measurements to obtain the right cables in the right length for your application.

18 From the inside, you can see Chris has already attached the stainless braided line to the caliper and connected it to the fitting on the axle tube using a tubing wrench. As with the front brakes, Chris also used copper washers between the banjo fitting and the caliper. This provides a perfect seal once crushed to its torque spec. These copper washers can only be used once, so if the banjo bolt is loosened for any reason, you'll need to have fresh ones handy and not reuse the old ones.

19 The Baer Pro+6P rear brakes are installed, and the system only needs to be filled with fresh brake fluid and bled. Baer's 6P caliper makes use of staggered piston diameters, meaning the trailing piston is larger than the leading piston. This prevents tapered pad wear, prolongs pad life, and dissipates heat better.

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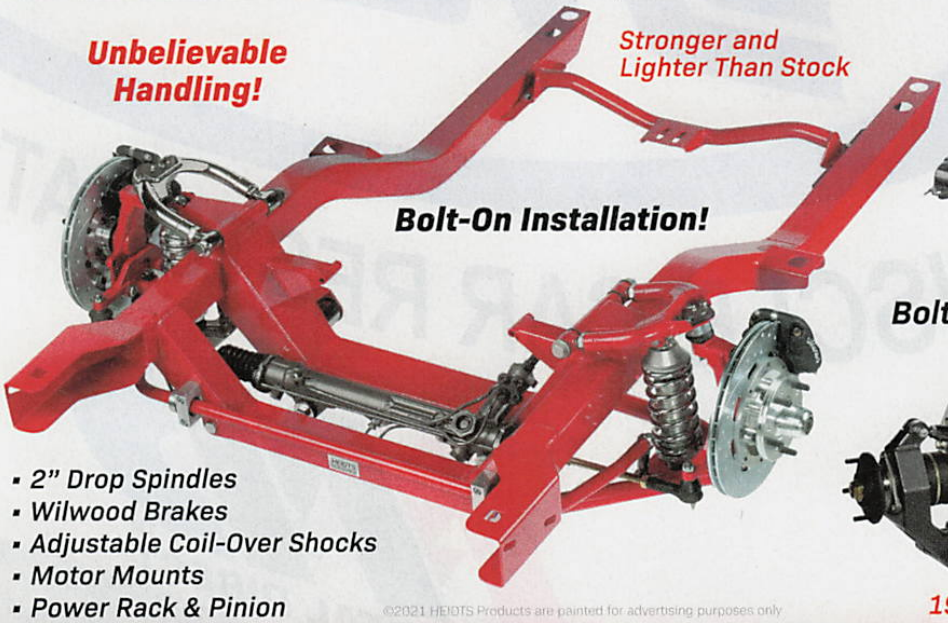

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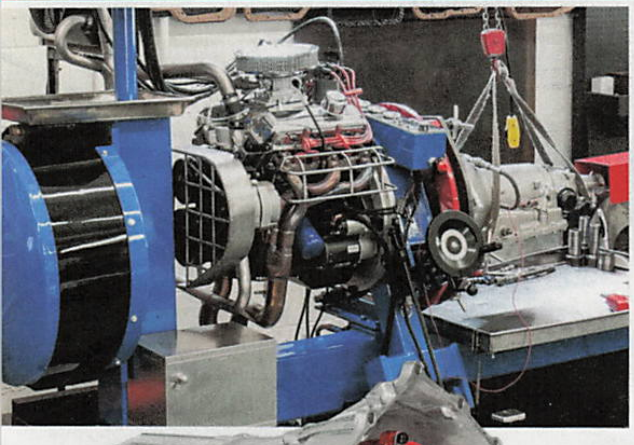

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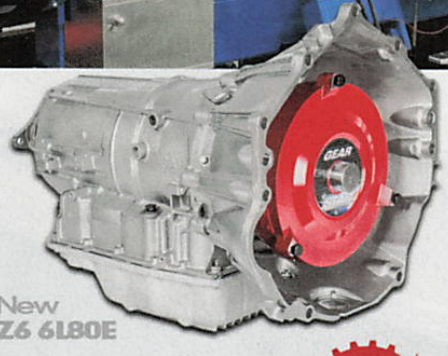

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MUSCLE CAR RESTORAT
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Rusty Dodge Coronet Taillight Panel Repaired

Mark Ehlen

We are fortunate to live in an era where there are lots of reproduction parts available for our favorite cars. In a few cases, you can buy an entire reproduction body! However, there still are some items for some cars that are not reproduced yet.

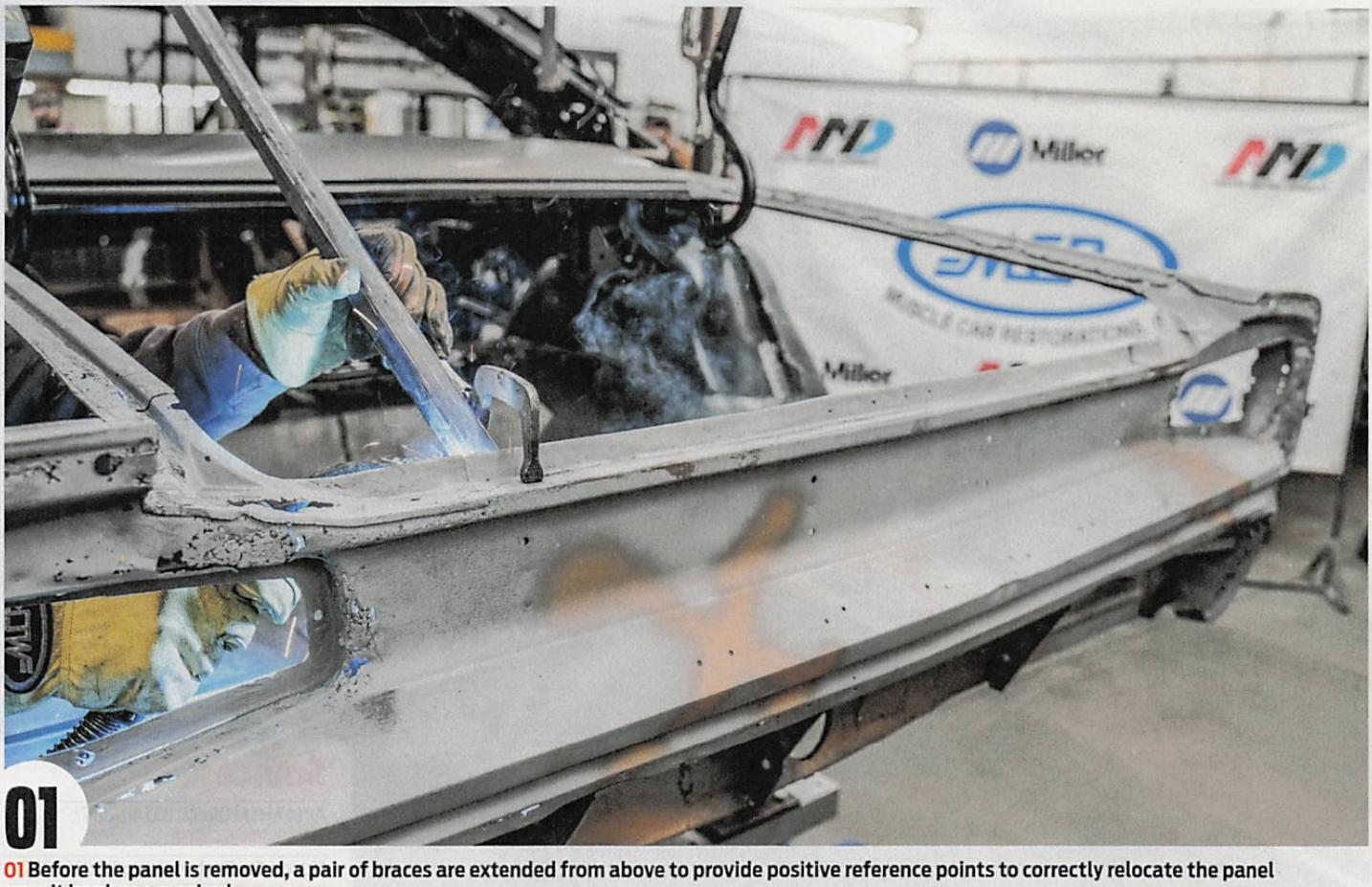
What do you do if you need a part that isn't available in the aftermarket and finding a useable replacement proves difficult? Muscle Car Restorations, in Chippewa Falls, Wisconsin, was in such a situation. No amount of searching (new or used) could produce a taillight panel for this '68 Dodge Coronet. Yes, it's a B-body and much of the sheetmetal is the same as the other models, but there are a few distinguishing features, and the tail panel is one of them. It also doesn't help that its taillight panel is a one-year-only design.

Sources

Auto Metal Direct; 833.404.4777; autometaldirect.com

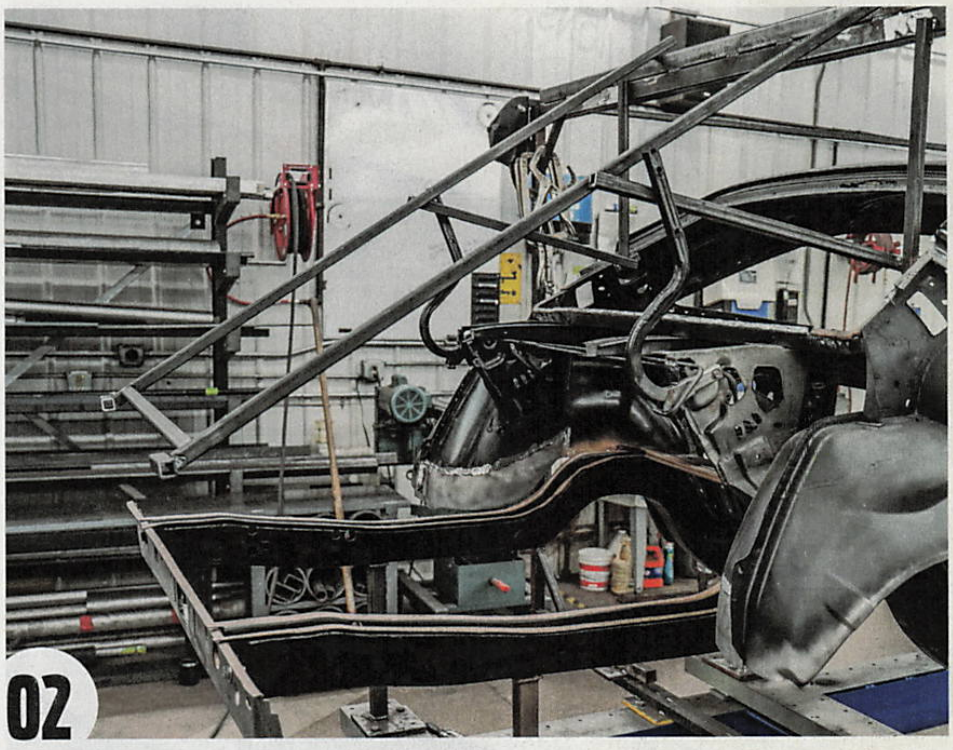
Muscle Car Restorations; 715.834.2223; musclecarrestorations.com

Fortunately, the guys didn't give up easily; they discovered that the bottom half of the '69 Coronet taillight panel is the same as the '68. Just the top half with the taillight openings is different. Given the number of patches that have been applied to the lower half of the panel during a previous restoration, this was good news. Follow along as we show how they spliced a '69 Coronet taillight panel into this rusty one from their customer's '68 model.



01

01 Before the panel is removed, a pair of braces are extended from above to provide positive reference points to correctly relocate the panel once it has been repaired.



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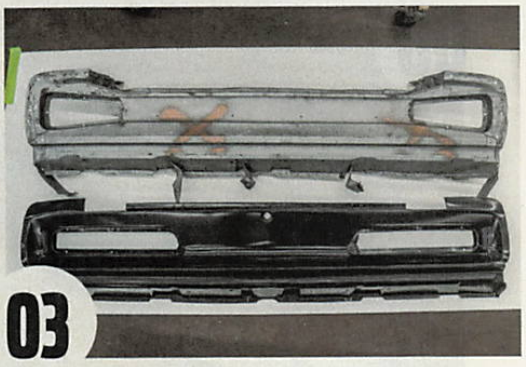

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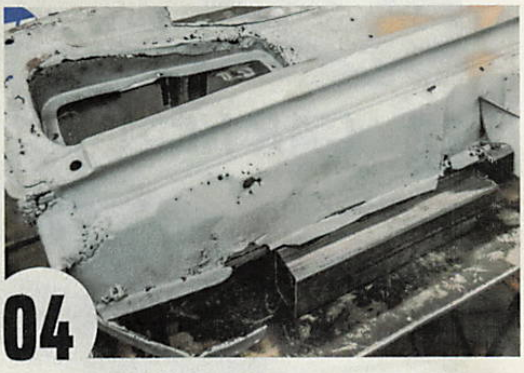

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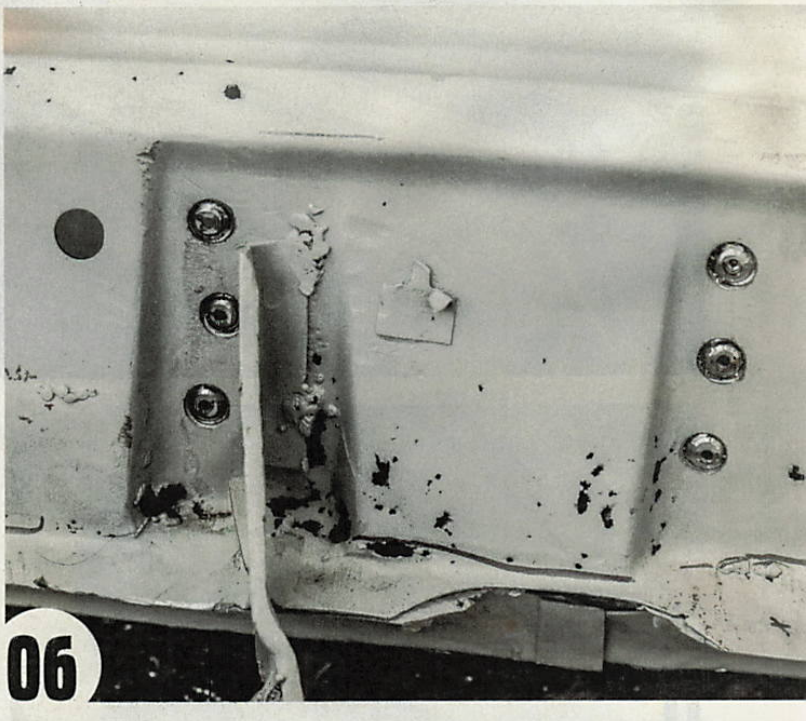


06

07

02 Yes, it looks a little goofy, but these braces provide the reference points necessary to correctly refit the panel.

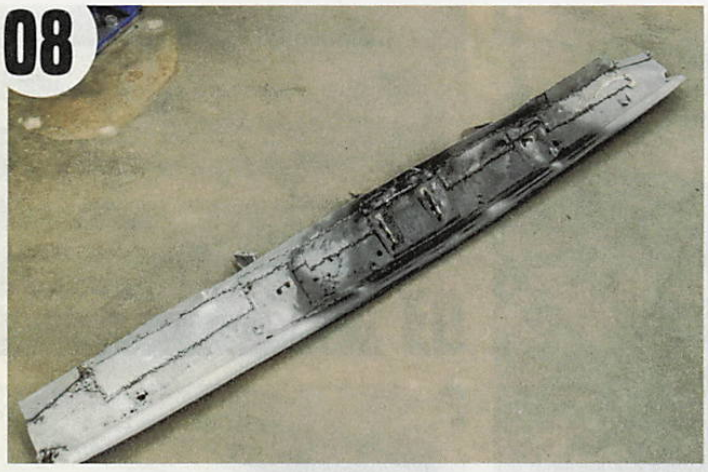
03 The top panel is from the '68, of course, while the bottom one is for a '69 model from Auto Metal Direct (AMD# 900-2469, $469.99). Fortunately, the bottom sections of these panels are identical, which will save Muscle Car Restorations (MCR), and the car's owner, from a considerable amount of fabrication work.

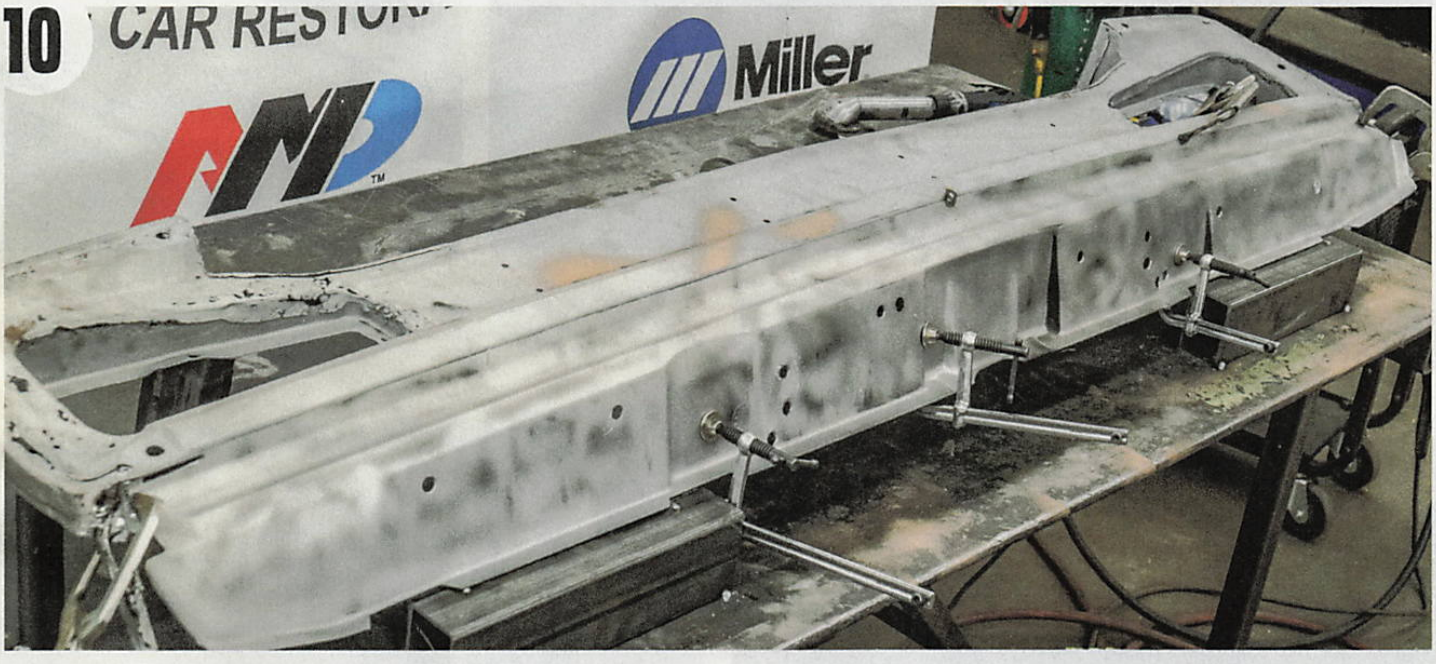
04 No, this is not the bad section of the panel. The whole thing looks like this.

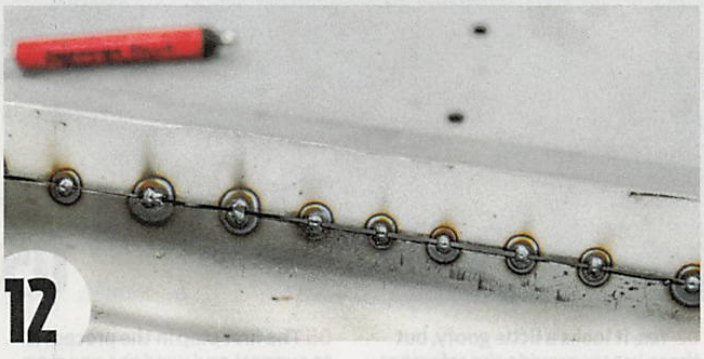
05 The first step in the process is to support and weld the panel to the table so the new section can precisely replace the old.

06 There are some brackets on the back side of the panel that can be reused, so they must be separated from the lower part of the panel. This one is the trunk lock bracket.

07 With the panel secured to the table so it cannot move, the lower section is trimmed off.







08 What an absolute mess! One might be better off fabricating this section from scratch rather than attempting to repair it. Happily, MCR won't have to do either.

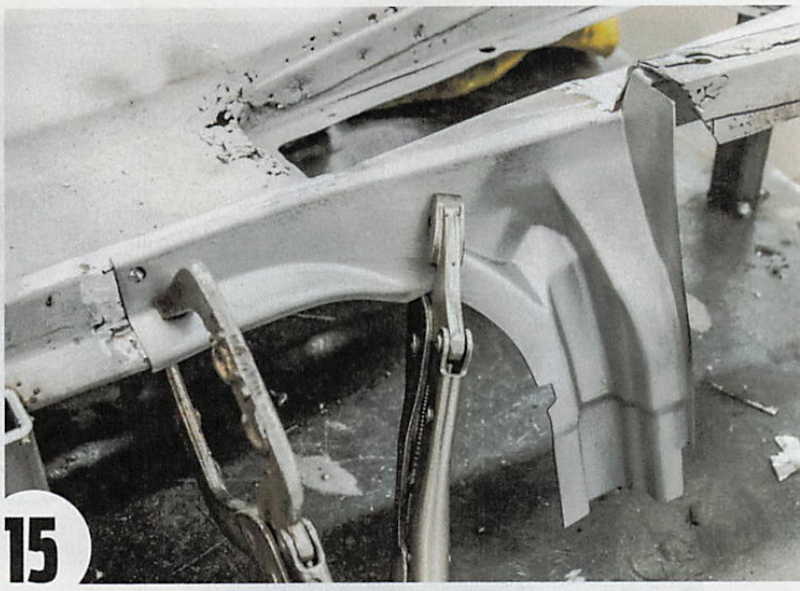
09 Here is the '68 panel without its lower section. The square tubes in front will positively locate the lower edge of the new panel.

10 The square tubes make it fairly easy to exactly position the new lower panel onto the old upper.

11 The splicing technique is the same as with any other panels that MCR joins. The new lower panel was trimmed a bit long so that a cut can be made through both parts to create the perfect sized gap for butt-welding the two together.

12 As the cut progresses down the panel, a tack weld is placed about every inch or so.

13 When the tack welding is completed and ground smooth, this seam will virtually disappear. Note the weld at the lower lip that secures it to the table during the process.



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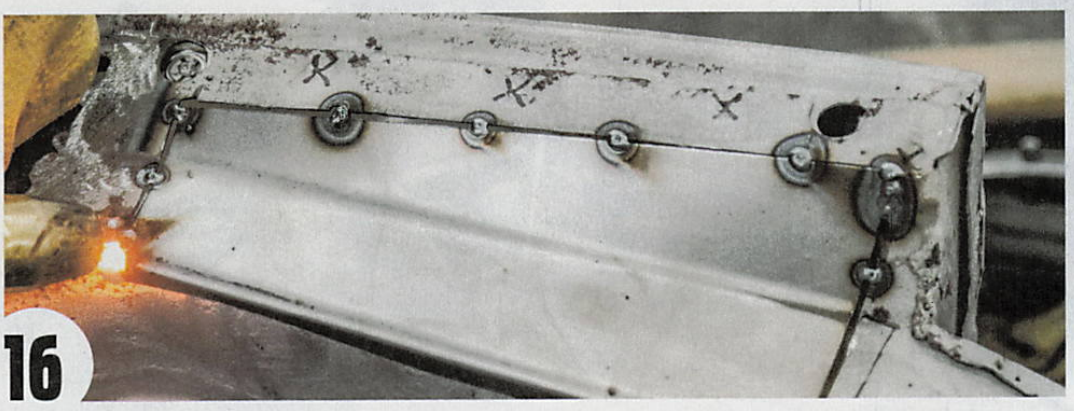


16

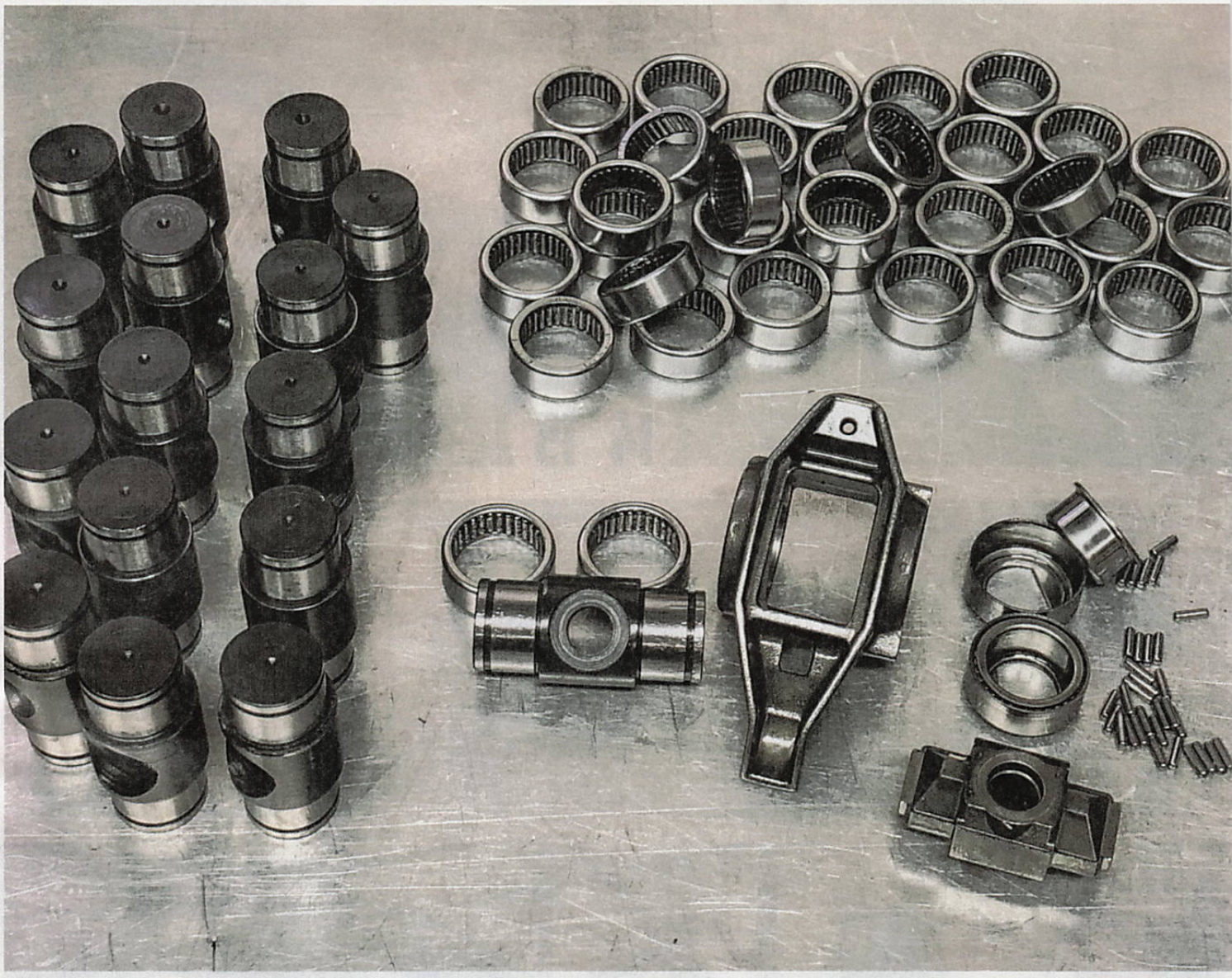
17

14 MCR is very grateful that the lower trunk gutters (AMD# 825-2468-L & R, $45.99 each) are available from AMD.

15 These reproduction trunk gutter pieces will save a considerable amount of fabrication work.

16 The rest of the taillight panel will have to be repaired one fabricated piece at a time.

17 Practically raised from the dead, this taillight panel is positioned and is now being refitted to the car.



Cheap Insurance

Build Fail-Safe LS Rocker Arms With This Needle Bearing Upgrade Kit.

Douglas Glad

High mileage or a high-performance camshaft swap: Those are the top two reported reasons for LS rocker-arm failure.

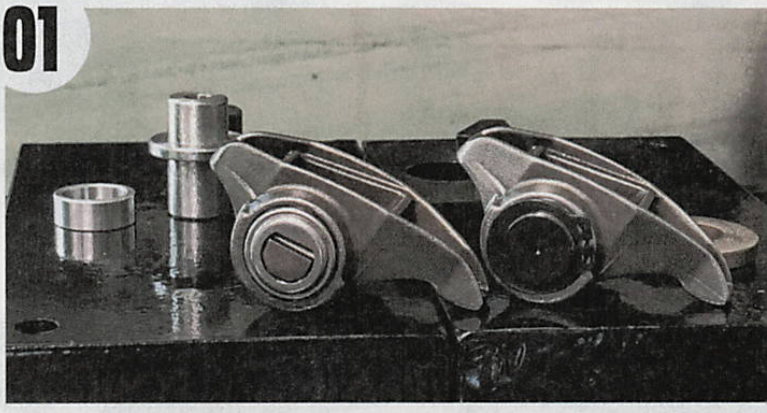
The symptoms are a miss with a ticking sound coming from the valve cover or needle bearings in the motor oil, or both. The problem is caused by uncaged bearings that spill out of the side of the arm when they fail from wear, or when the lift of the new cam exceeds the design of the bearing cap, pushing it out of the rocker-arm body.

Rather than risk this on our LS3, we installed an LS rocker-arm bearing upgrade kit from Summit Racing Equipment that replaces the factory bearing and trunnions and adds the safety of snap rings to keep it all in place.

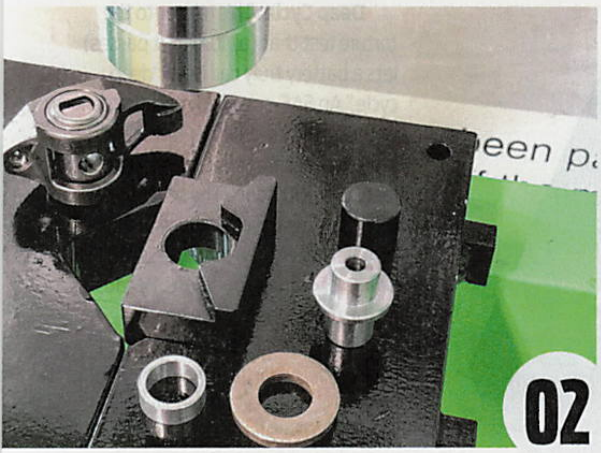
Sources

OEM Tools; 888.453.5148; toolsid.com

Summit Racing; 800.230.3030; summitracing.com



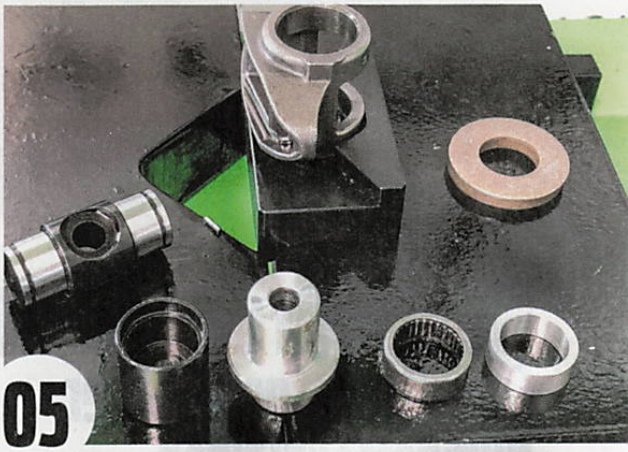
01 The factory rocker arm is on the left, and the upgraded arm on the right. Note the bearing cap on the left has a travel limit. If the cap is damaged or fails, there is nothing keeping the needle bearings inside the body of the rocker. On the right, a caged bearing and a snap ring keep the bearing in place and allow the trunnion to rotate 360 degrees.



02 The upgrade kit requires the rocker-arm bearing vice installation tool (PN: SME-906011) that, as the name implies, allows this job to be done using a bench vice. The tool includes the mandrel and every part required to do the job. We used our OEM Tools pneumatic press to speed up the process.

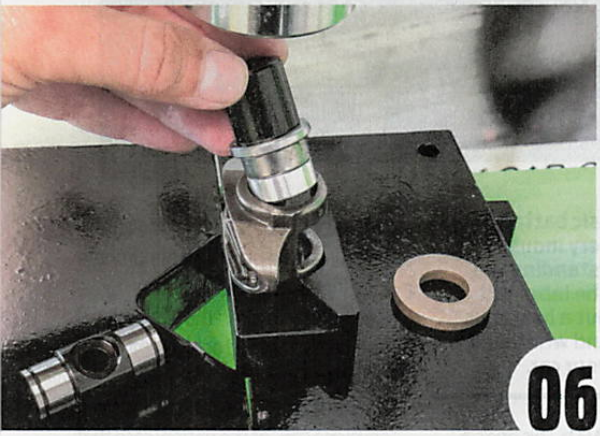
03 The kit is part number SME-143002 from Summit Racing. It includes two new bearings, a new trunnion, and two snap rings.

04 The factory bearings and trunnion are driven out using a hollow end cap.

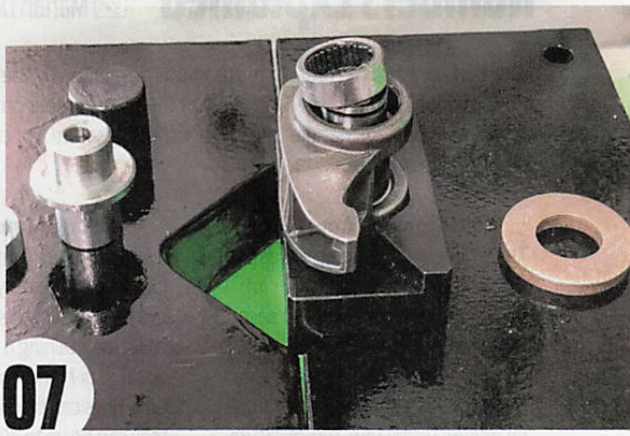


05 This is the installation tool in order of assembly from left to right. The end cap fits over the mandrel that guides the bearing and alignment sleeve into the rocker-arm body.

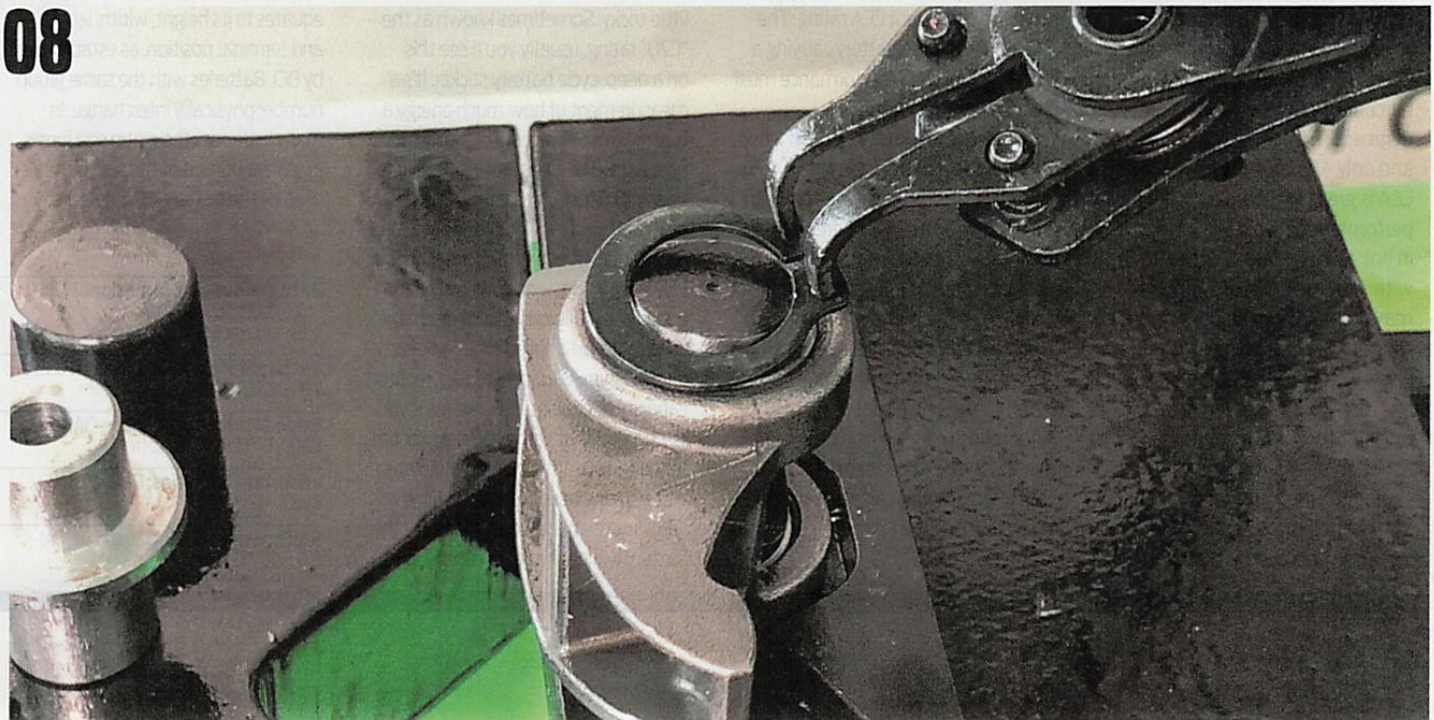
06 The mandrel has a positive stop that forces the bearing into place. Clean the trunnion with brake cleaner, lightly oil with WD-40, and grease the inside of the bearing with assembly lube.



07 After the first bearing is installed, flip the rocker-arm body over, install the trunnion, and use the washer to press the second bearing into place.



08 The last step is to install the snap rings on both ends of the trunnion. Reinstall the rocker arms and adjust the valves using the Exhaust Open/Intake Closed method. You can find that procedure by searching HOTROD.com.



Interstate Battery

Get High on Cranking:
Car Battery Specs Sticker Numbers Explained

Marlan Davis

Car battery specs conform to standards developed by the Battery Council International (BCI) and the SAE. Many of the specs appear on the battery label as well as in battery manufacturers' published literature. For car guys, the most important specs are:

Cold Cranking Amps (CCA): The discharge load in amperes that a new, fully charged battery can deliver at 0 degrees F for 30 seconds while maintaining a voltage of 1.20 volts/cell or higher. This measures the battery's ability to start (crank) an engine under low-temperature conditions where the chemical reaction inside the battery slows down: A battery puts out 100 percent of its rated power at 80 degrees F, 65 percent at 32 degrees, and only 40 percent at 0 degrees. CCA is great for comparing battery performance in cold climates, but in hot climates lead-acid batteries with extremely high CCA ratings may actually have a shorter life than those with lower ratings: Within a given overall battery case (group) size, upping the CCA requires thinning out the internal plates to squeeze more out of them within the same case volume. Thinner plates are more susceptible to vibration and overheating.

Cranking Amps (CA): The discharge load in amperes that a new, fully charged battery at 32 degrees F can continuously deliver for 30 seconds while maintaining a terminal voltage equal to or higher than 1.20 volts/cell. CA ratings can be misleading because they can be up to 30 percent higher than the equivalent CCA rating. The BCI requires that a battery carrying a statement of its CA performance must also list its CCA capacity.

Reserve Capacity (RC): If listed, is the number of minutes a new, fully charged battery at 80 degrees F can be discharged at 25 amperes while maintaining a voltage of 1.75 volts/cell or higher. For a 12-volt battery (six cells), RC is the number of minutes it can maintain a voltage of 10.5 volts with a 25-amp draw; therefore, a "75-minute" battery lasts 75 minutes under these conditions. The bigger the RC, the better; modern cars with lots of accessories can see a current discharge rate that is much greater than 25 amps.

This Exide Classic battery label is typical of battery industry markings. Understanding the information on the label will help you figure out a battery's characteristics and whether it's the right fit for your car.

Amp-Hours (AH): This one's a little tricky. Sometimes known as the "C20" rating, usually you'll see this on a deep-cycle battery sticker. It's a measurement of how much energy a battery can deliver continuously for 20 hours at 80 degrees F without falling below 10.5 volts. If a battery is rated at 100 amps/hour, it will supply 100 amp/hours of power, or 5 amps/1 hour. However, as BatteryStuff.com points out, in the real world, "total discharge time and load applied is not a linear relationship. As load increases, realized capacity decreases. This means if you discharged that same 100 amp/hr battery by a 100-amp load, it would not give you one hour of runtime. On the contrary, the perceived capacity of the battery will be that of 64 amp-hours."

Deep Cycle: This relates to the torture test that (assuming it passes) lets a battery truly call itself "deep cycle." An SAE-specified measurement of the battery's ability to withstand repeated discharge/recharge cycles, it lasts over 100 hours. The severe test offers the best overall gauge of automotive battery performance under severe operating conditions. Because of the test's severity, you generally won't see this info published except for batteries specifically designed for "deep-cycle" service. Deep-cycle batteries are typically used on race cars without an alternator that require a between-rounds recharge, or in a street car that sits in a parking lot for hours with a high-amp stereo system on and the engine off.

Date Code: Most batteries have a date code, usually a long string of numbers and letters, that show when the battery was purchased. One row of one- or two-letter codes indicates the month, the other row of numbers is the last digit of the year. The relevant date code in the ID should have been stamped or highlighted at the time of purchase.

Group Size: This is the standard "envelope size" of the battery case that equates to its height, width, length, and terminal position, as established by BCI. Batteries with the same group number physically interchange. In many instances the group size forms at least a portion of the part number used by the battery manufacturer.

Sources

Battery Council International (BCI); Chicago, IL; 312.245.1074; batterycouncil.org

BatteryStuff.com LLC; Grants Pass, OR; 800.362.5397; batterystuff.com

Exide Technologies; Milton, GA; 800.START.IT; exide.com

Interstate Batteries; Dallas, TX; 866.842.5368; interstatebatteries.com

SAE International; Warrendale, PA; 877.606.7323; sae.org

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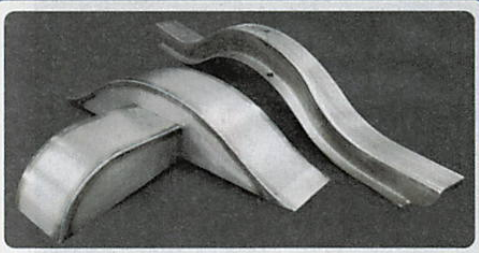

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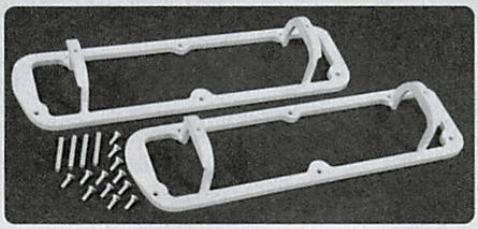

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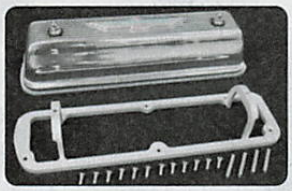

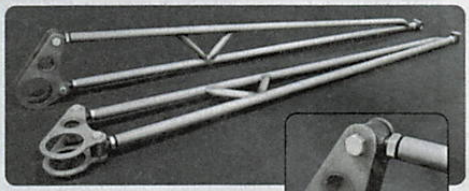

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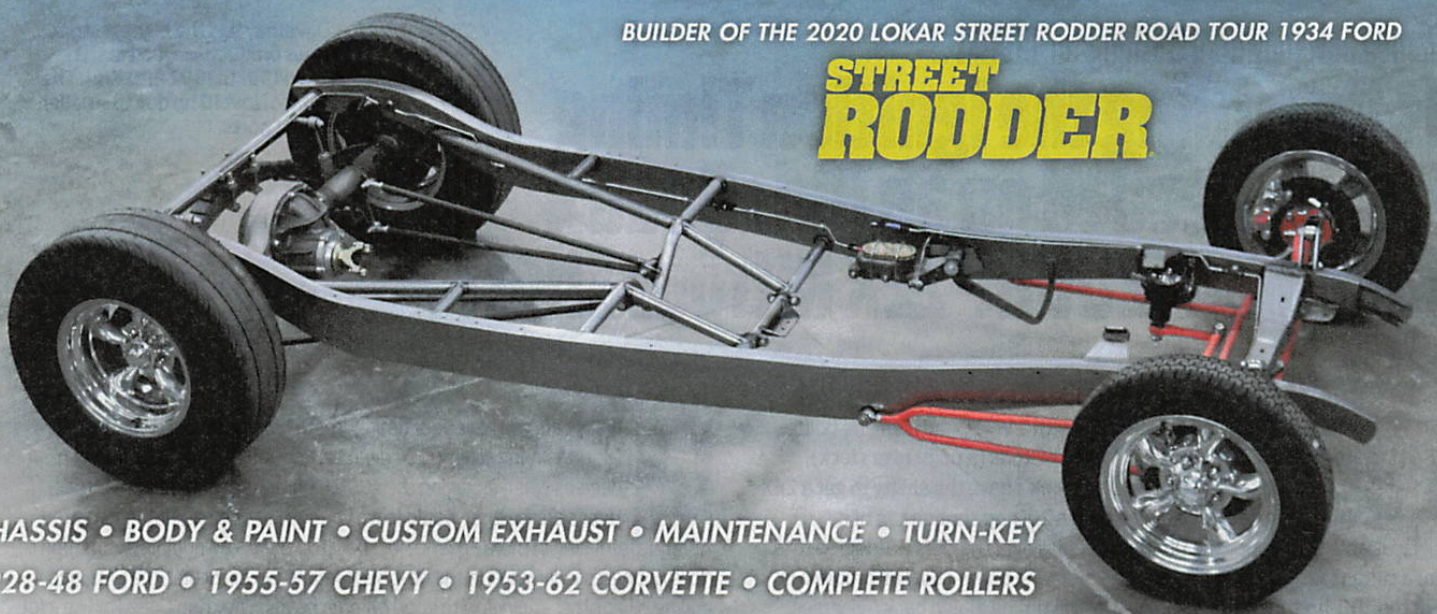

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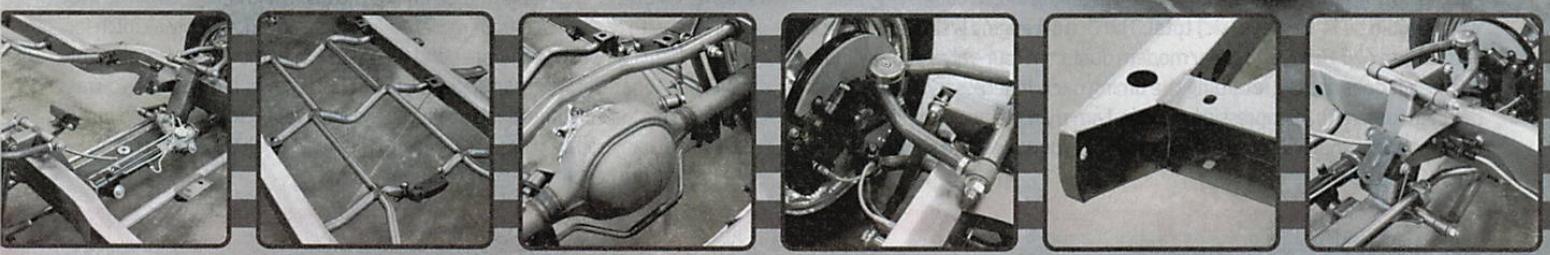

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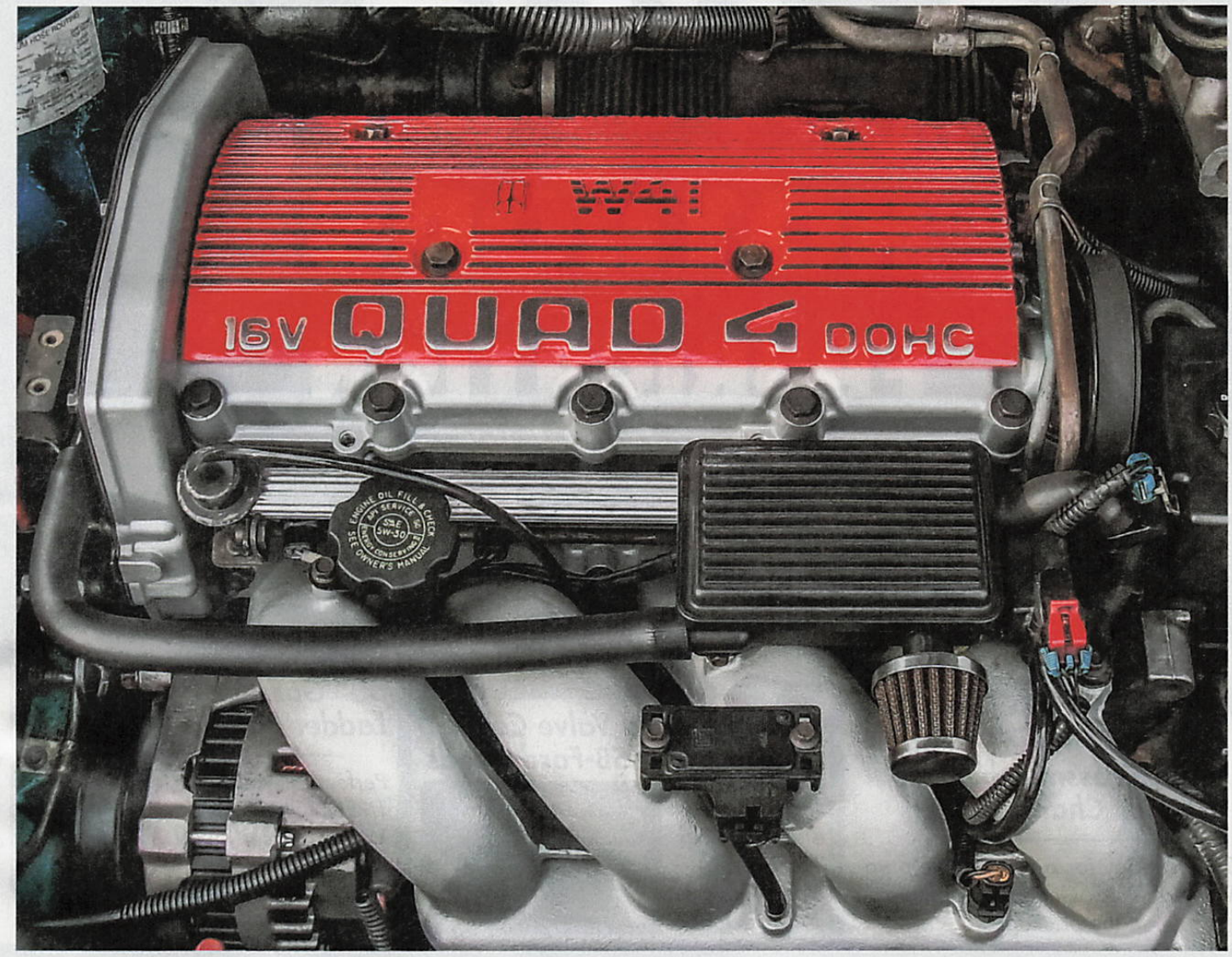


Kevin Davis via Wikipedia

Duvernay has the highest stock output production Quad 4: the 190-hp 1991 to 1992 RPO W41. The 1993 W41 lost 10 hp due to smaller exhaust ports.

Ramon Duvernay from Washington, DC Asks ...

Is Retarding the Ignition Timing Really Needed on an Olds Quad 4 Running a 200HP ZEX Nitrous Shot?

Marlan Davis

Q: I have a 1992 Olds Achieva SCX with a W41 Quad 4 engine built for 250 to 270 hp with 11:1 forged pistons (a point over stock), forged rods, and a cryotreated crank. I have the ability to get a ZEX [nitrous oxide] kit, so I can drop a 200-hp shot on top of it.

I was able to advance the timing 4 degrees over the OEM 20-degree total, for a current setting of 24 degrees on 93-octane pump gas. The problem is: For the 200-hp shot nitrous, ZEX wants the timing dialed back 6 degrees, which would be 14-degrees [sic] total. The Quad 4 engine is similar to the old second Gen 426 Hemi, and other modern dual-cam four-valve, four-cylinder engines: It does *not* like retarding the timing back. If necessary, I can go back down to forged 10:1 compression pistons. I am trying to avoid dialing the timing back as much as possible. What would you suggest to set the total timing at to do this?

A: It appears you have your timing "math" wrong. If your current total ignition timing tuning is 24 degrees, and you dial back the timing 6 degrees when engaging the 200 ZEX nitrous shot per the manufacturer's advice, that would leave you with 18 degrees, not 14 as stated. At any rate, dialing in more advance just because there's no audible detonation does not necessarily result in the best performance. In particular, the GM Quad 4 engine is like other engines with good cylinder heads: They don't need or like a lot of timing, with or without nitrous oxide. Adding more advance is only a crutch for an inefficient combustion chamber, and the Quad 4's chamber was very efficient for its day. Whatever timing an engine likes without a power adder, when you're running a big load of nitrous, you nearly always must retard the timing and run colder heat-range spark plugs. We'll get into the "why" of all this in a moment, but first, for the benefit of our V8-centric readers...

ASK MARLAN A TECH QUESTION: PITSTOP@HotRod.com

Please provide a daytime phone number so we can contact you for more information if necessary. Questions will be answered in the print edition or on HotRod.com.

J. Robb Henley via Wikipedia

A 1992 Oldsmobile Achieva SCX Coupe W41 with just 29,000 miles on the clock when it was photographed back in 2012. W41 2.3L Quad 4 engines were available in the 1991 Olds Cutlass Calais and 1992 to 1993 Olds Achieva SCX.

What the Heck is a Quad 4 Engine, Anyway?

Introduced to the public in spring 1987, the iron block/aluminum head, inline, 2.3L (137.9 c.i.), Quad 4 engine was the first fully domestic DOHC (dual overhead cam) four-cylinder designed and built by GM. It proved to be a fairly successful attempt by Oldsmobile (and GM) to show that it could produce a modern four-cylinder engine with comparable sophistication and output to GM's import competitors. Quad 4 engine factory-stock power ratings ranged from 150 to 190 hp, with torque coming in at 160 to 180 lb-ft.

The 190-hp 1991–1992 RPO "W41" was the highest output Quad 4 engine sold to the public. At 1.38 hp/c.i. it outpaced the contemporary

Sources

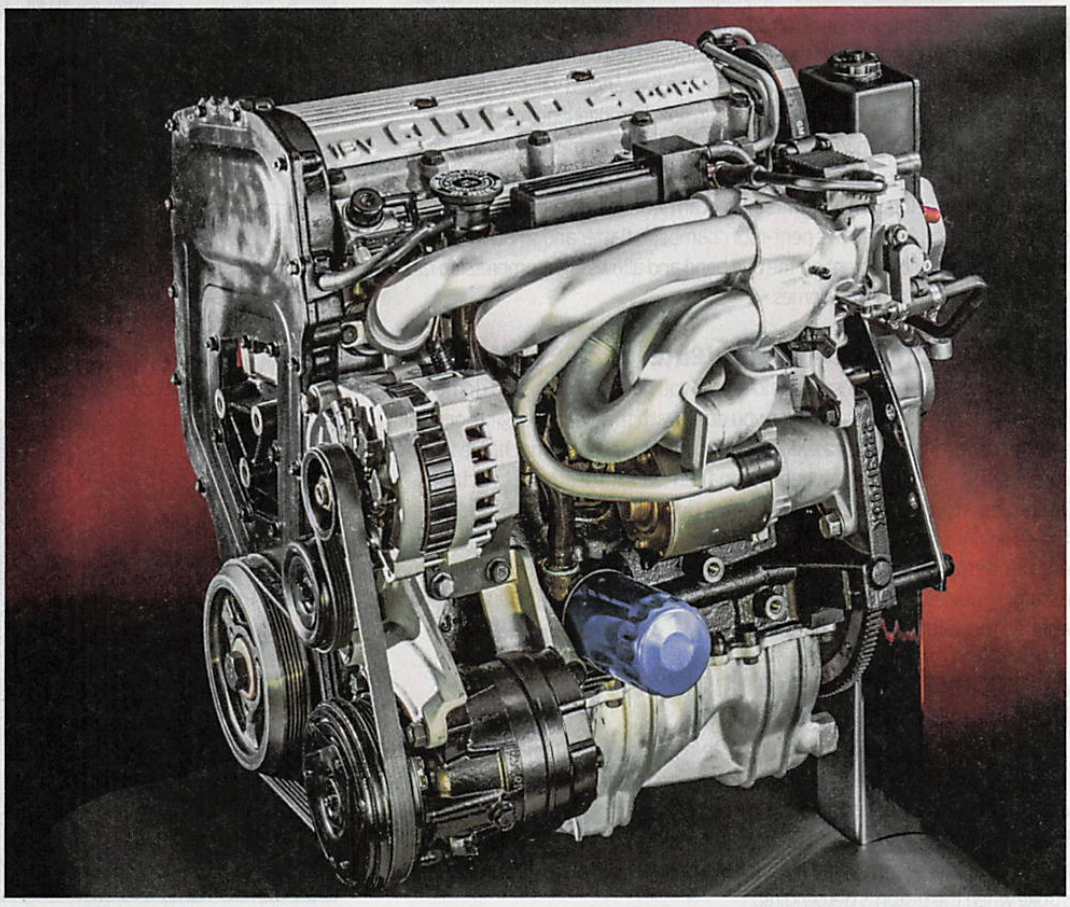
Fuel Air Spark Technology (FAST); Memphis, TN; 877.334.8355; fuelairspark.com

Holley Fuel Injection; Bowling Green, KY; 866.464.6553; holley.com

Machinehead Powersports; Dripping Springs, TX; 909.240.9330;

Summit Racing Equipment; Akron, OH; 800.230.3030; summitracing.com

ZEX; Memphis, TN; 888.817.1008; zex.com



Oldsmobile's development of what would become the Quad 4 engine dates to at least 1984. This GM photo depicts a 1986 prototype. An inline-four with four valves per cylinder, the Quad 4 was innovative for its day. The eventual production standard Quad 4's 160 lb-ft/150 hp rating was better than competitive BMW and Mercedes four-cylinders, and not far off Honda's 2.5L V6. Note the tuned header-like intake runners on the early build.

1990–1992 Chevy Corvette's optional DOHC Lotus-headed 5.7L (349.5 c.i.) LT5's published 375 hp or 1.07 hp/c.i. However, Olds built or sponsored several hopped-up versions that found their way into the 1988 Indy 500 pace car, as well as full-on race derivatives used to set FIA closed-course speed records.

In various forms, the Quad 4 engine architecture lasted through 2002 before being replaced by the Ecotec (later 2.4L Quad 4s' were just called "Twin Cam" engines). The Quad 4 family was the last engine engineered and produced solely by Oldsmobile.

Fairly advanced for its day, the main media criticism was in the NVH (noise-vibration-harness) department compared to its foreign competition. Various measures were undertaken to reduce this, culminating in the 1996 RPO LD9 Twin Cam 2.4L (146 c.i.) version with balance shaft and a redesigned cylinder head. Other deficiencies that came to light as these engines aged included timing chain failures, water pump failures, and small oil passages that could clog up if the engines weren't maintained properly.

Although the Quad 4 shares many similarities with that era's foreign DOHC four-cylinder competition, it has little in common with the old giant 426 Gen 2 Chrysler Hemi, which had huge full-hemispherical combustion chambers, two valves per cylinder and a pushrod-actuated valvetrain. A Quad 4 has a pent-roof chamber with four valves per cylinder actuated by two overhead camshafts. Both 426 Gen 2 Hemi and the Quad 4 are better than an old-school Wedge-shaped combustion chamber, but that's about the only real similarity they share. It's true the 426 Hemi seems to like timing best in the low 30-degrees area, about 5 to 6 degrees fewer than most of its legacy-era Wedge-head engine competitors, but not even close to your Quad 4 or, for that matter, the modern LS/LT V8 GM small-blocks.

What's the Deal with a Four-Valve, Pent-Roof Combustion Chamber?

The better the combustion chamber the less timing you need. An Olds Quad 4 engine has what is today called a "quick-burn" combustion chamber, a chamber that inherently requires less ignition advance. On the Quad 4 engine's pent-roof, four-valve chamber, the valves angle inward toward the center of a small chamber, facing toward a centrally located spark plug. The four angled valves cause the incoming air/fuel charge to tumble, ensuring more homogeneous distribution within the combustion chamber. The valve curtain area of four small valves is greater than two large valves installed in the same size combustion chamber/cylinder-bore envelope. This allows smaller cam lobes without compromising top-end performance. A four-valve pent-roof chamber is flatter and smaller in volume, which speeds the flame front on the one hand and allows high compression ratios without large pop-up piston domes.

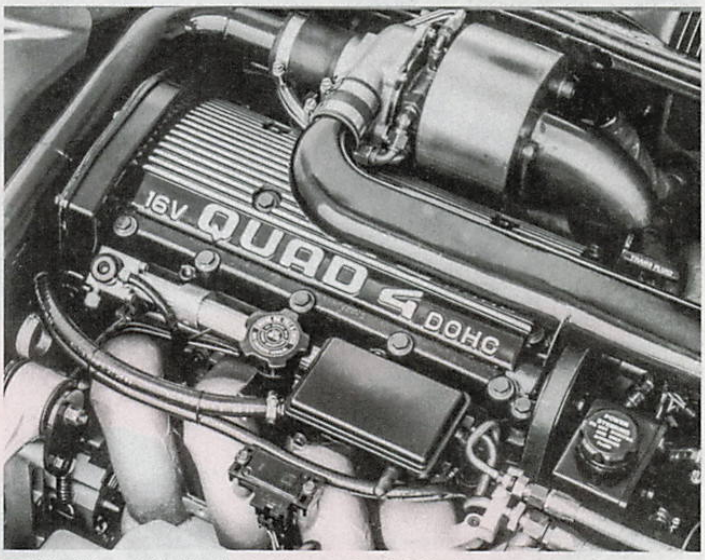
Higher Compression Equals Greater Engine Efficiency

Don't lower the compression ratio unless you have a huge piston dome that inhibits the flame front, which you don't with the Quad 4 engine, or if the engine has "artificial compression" from a supercharger or turbocharger. Higher compression—up to a point where detonation rears its head due to octane limitations—is worth power and efficiency. On normally aspirated, gasoline-fueled engines running high-octane race gas, you'll see significant gains on most engines through around 14:1, or through about 16.5:1 on methanol. Beyond that—assuming no detonation—there may still be some gains, but at that point you've entered the realm of diminishing returns.

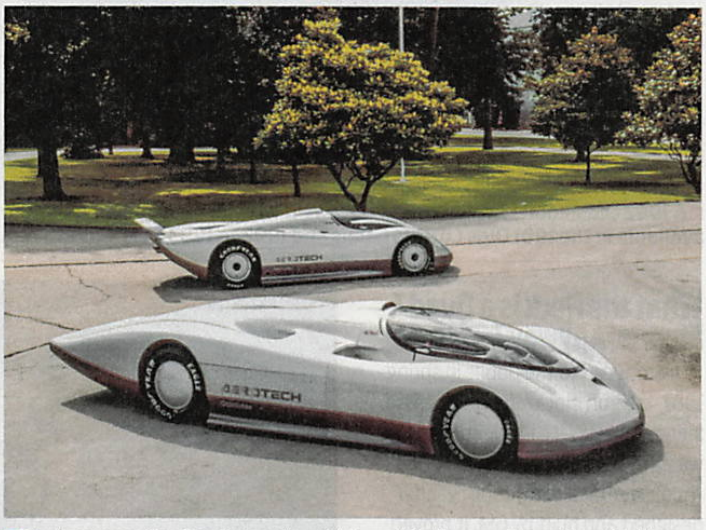
Advancing the Ignition Timing Doesn't Necessarily Add Power

OK, so what about ignition timing tuning in general? Additional timing (aka ignition advance, aka "lead") means the engine is inherently "fighting" or working against itself because spark initiation occurs earlier in the combustion stroke when the piston is still rising toward TDC on the compression stroke. In a perfect world, all "push" on the piston should theoretically occur at and after TDC on the power stroke when the piston is descending.

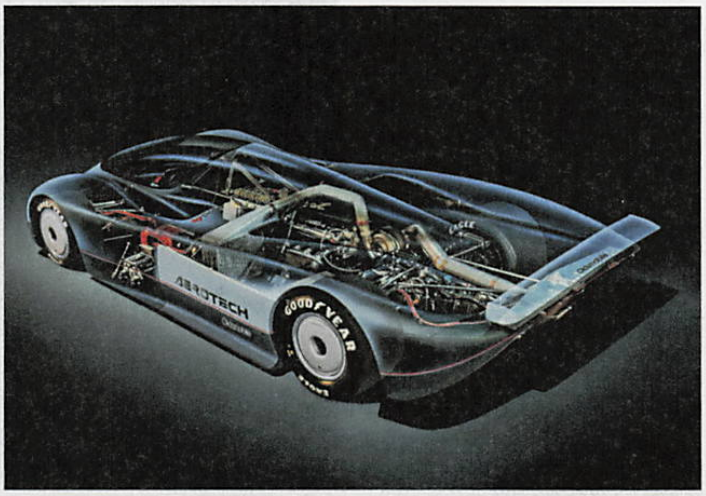
In the real world, "zero lead" doesn't work well because during a controlled combustion event, it takes a certain amount of time for the flame front to progress entirely through the combustion chamber and consume the air/fuel charge. One



This Oldsmobile PR photo shows what it billed as a "pre-production" turbocharged Quad 4 in the 1988 Indy 500 Cutlass Supreme pace car. Rated at 250 hp at 6,000 rpm, the turbo package never materialized in a production car.



To showcase the Quad 4 engine, Oldsmobile financed a series of full-on Aerotech race cars with the intention of breaking multiple speed records. There were both short-tail (ST) and long-tail (LT) versions built and financed by GM. The ST had more downforce, the LT better aero. In 1987, A.J. Foyt set an FIA two-way flying mile speed record of 267.399 mph in the LT and a closed-course record of 257.123 in the ST.



Shown here is a GM cutaway depicting the Aerotech short-tail body with Batten's 900 hp single-turbo engine. The car's lightweight carbon-fiber body rode on a March Engineering 84C CART chassis, the same chassis that was used in the winning car at the 1985 Indianapolis 500.

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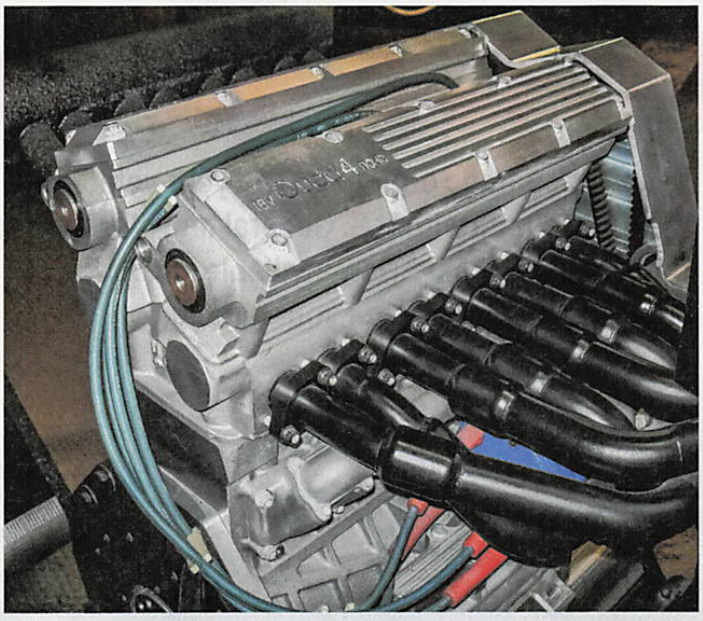

Toneron2 via Wikipedia

This is the one-off 1,000-hp twin-turbocharged Quad 4 engine that set the top speed records in an Aerotech LT driven by A.J. Foyt. Ed Taylor, who worked with Jim Feuling on the engine, recently revealed the supposedly "production-based" engine used a one-off custom billet aluminum block where the center head studs go clean through the entire block from heads to main caps. Kind of like an old Offenhauser IndyCar block, eh?

must compromise to ensure completing most or all of the burn at or just slightly after TDC, which is why you always need some advance—just not too much!

Important! Just because advancing the ignition timing tuning doesn't cause engine knock does not mean that's the best total timing for the engine. The best amount of total ignition advance is that amount of timing where the engine makes the most horsepower. That may be more, the same, or less than what you are running now. The only way to know for sure is to put the car on the dyno in its current, non-power-adder condition and see. Try different amounts of timing, and make sure your target air/fuel ratio is correct.

The Factory Computer Won't Cut It with a 200 Shot ZEX Nitrous Kit

I have to say if you are making 250 to 270 hp now, you likely have cams and cylinder head work because that's about a 35 percent increase in power over stock. I'm assuming at this level you are not relying on the factory computer; those early factory computers require burning a new "chip" every time you needed to make a tuning change—what a pain! Tuning will be even more complex with the big nitrous shot, so you really need an aftermarket, user-reprogrammable unit that's also capable of retarding timing when the nitrous hits. We're talking around 450 hp here! Take a look at the higher-end FAST or Holley systems.

A 200 Shot ZEX Nitrous Kit Demands Less Timing and Colder Plugs

Once you have the car dialed in as good as it can get without the power adder, let's consider timing with nitrous oxide. Ed Taylor worked with Jim Feuling on the 1,000-hp Quad 4 record-setting engines and has extensive experience with the engine at Bonneville. "When running any power-adder, you need to pull timing out of *any* motor," he explains. "But a large nitrous shot initially *hits 100 times harder* than a turbocharger or supercharger—that's when you break pistons! And why those running a large amount of nitrous usually run a staged or fogger-type setup."

Machinehead's Ken Crocie has built all sorts of large and small engines, including the Quad 4 engine. He says the general conservative rule of thumb with nitrous is to pull the timing back 3 degrees for every 100 hp the nitrous adds. That's right in line with ZEX's advice: 200 hp, retard timing 6 degrees. The reason this won't "hurt" you is that nitrous burns much faster, so—even though nitrous significantly cools the incoming charge—that accelerated burn rate mandates less timing to avoid detonation. If you *really* know how to tune, Crocie says you *might* get away with retarding just 2 degrees/100 hp (for a total of 4 degrees), but start out conservative and dial it in before experimenting, or (at a minimum) you'll burn the electrode clean off the spark plug. At worst, you can burn valves or a piston. The air/fuel delivery must be spot on.

Sustained use of large amounts of nitrous oxide raises cylinder temperatures and may require a plug at least 1–2 heat ranges colder—or even more. Don't use a projected-tip plug. Tighten up the plug gaps as needed. For more on spark plug heat range and gaps, see: "10 Factors That Affect Correct Spark Plug Head Range" and "Does Side-Gapping Spark Plugs Work?" on hotrod.com.

Bottom line: Run as little advance as possible on any engine, so long as the engine doesn't lose power. The more efficient the engine, the less timing. The better the chamber, the less timing, The higher the static compression ratio the less timing. The quicker the burn-rate, the less timing. As Crocie puts it, "An engine wants the timing it wants!"

ZEX's universal four-cylinder direct-port EFI nitrous system is adjustable from 50 to 200 hp. It has a unique dual-stage jetting system for much finer cylinder-to-cylinder tuning options. PN 82030 is $840.99 at Summit Racing (as of late July 2020).

Why Was the Olds 2.3L Quad 4 W41 Engine Good in Its Day?

- **A stock normally** aspirated 1992 Olds 2.3L (137.9ci) Quad 4 W41 engine made 160 hp back in 1992 or about 1.38 net hp/c.i., equal or better than most of its foreign competitors.
- **Even the base** 150-hp 2.3L Quad 4 engines made 1.09 net hp/c.i. back in 1988. The 1988 Corvette L98 TPI aluminum-headed 350 made 245 net hp, just 0.7 hp/c.i.
- **Chain-driven** DOHC cams are more durable than a timing belt.
- **Race-built** twin-turbo 2.3L Quad 4's made over 1,000 hp (7.25 hp/c.i.), enough to capture the FIA closed-course top-speed record.
- **Four valves/cylinder** have more curtain area than a two valve/cylinder arrangement.
- **Quick-burn** pent-roof chamber with centrally-located spark plug yields a faster burn.

Ignition Timing Tuning:

More Advance Isn't Necessarily Better

- **The best total** ignition advance is that amount of advance where the engine makes the most horsepower.
- **Just because** more ignition advance doesn't put the engine into spark knock does not mean that's the point where the engine makes its best power.
- **More ignition** advance may be counterproductive because, with the piston still rising on the compression stroke, the engine is working against itself.
- **The amount** of base timing that produces the highest idle vacuum (best idle quality) may not yield the best peak power, even if the engine idles better.
- **An efficient** combustion chamber needs less ignition advance.
- **Old, lazy** Wedge-style combustion chambers need more timing than modern, quick-burn chambers.
- **Higher static** compression ratio needs less ignition advance.
- **Nitrous oxide** needs less ignition advance (retard timing 3 degrees for every 100 hp added).
- **Forced induction**—supercharging or turbocharging—requires less ignition advance under boost.

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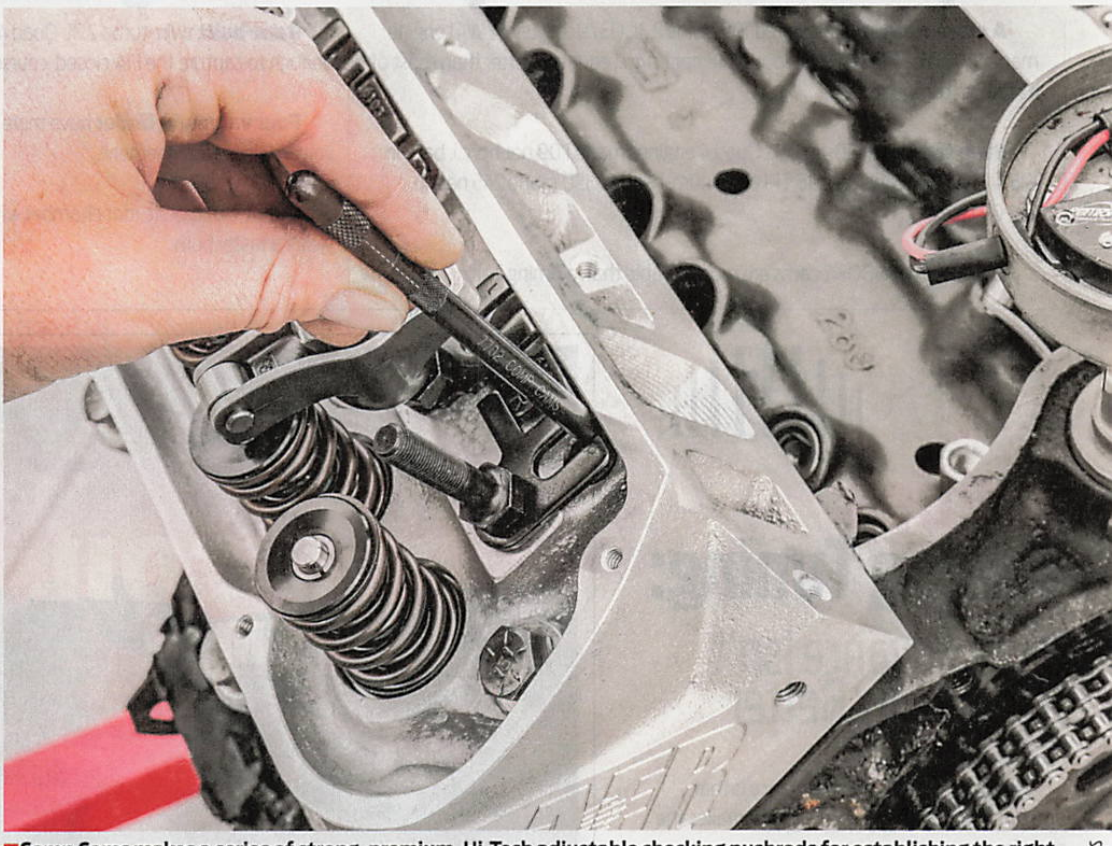
To Spring or Not to Spring



Comp Cams makes a series of strong, premium, Hi-Tech adjustable checking pushrods for establishing the right pushrod length needed for best valvetrain geometry. They're sold individually in 1-inch adjustable increments or collectively as kits. Versions for determining cup-style pushrod lengths are also available.

Comp Cams

Q: When doing a pushrod length check on a GM 350, do I use double valvesprings, or should I take one out?

Kenny Matheis
Via email

A: Gee, Kenny, I don't know. It depends how cute the spring is. (Groan.) Theoretical answer: Depending on the quality of the checking pushrods versus the actual pressures of the valvespring pack used in the engine build, there's a chance you could bend or damage the adjustable pushrods used for determining pushrod length versus valvetrain geometry. So, most cam and valvetrain specialists, including Comp Cams, officially recommend using either light pushrod length checker springs or the inside element of the dual- or triple-spring you're running. Another plus with "light" springs is that with lower valvetrain loads, the engine won't try to snap around going up and down the cam flanks as you hand-cycle the crankshaft. That arguably makes the critical rocker arm tip sweep contact-patter across the valve stem top smoother.

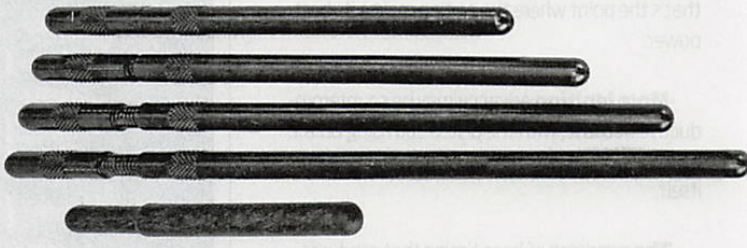
But whether a smoother full valve-open/valve-close cycle produces the greatest accuracy in the end is another question, because light springs may not fully simulate max-lift valvetrain deflection when open valvespring pressure is at its highest. Assuming your adjustable pushrods are capable of handling the actual loads your springs will see and you have Popeye arms that can sustain a full, smooth, roll-through, your measured results may better match real-world running conditions.

Finally, don't forget the pushrod length check should be done with proper valve-lash (on mechanical cams) or proper lifter preload (on hydraulic grinds). Either needs to be done before you can do a full engine roll-through. Lash and preload are set statically, on the cam base circle, so any spring works for that purpose.

Practical answer: In the real world, pushrods are usually the last thing ordered after completing engine assembly, so in practice most of us just do that one final check with the "normal" valvespring package already on the cylinder heads if we can get away with it—but if you notice your checking pushrod bending, stop and do it "by the book" with light springs.

Valvespring Considerations for Establishing Pushrod Length

- **Any springs work** OK for determining the right pushrod length, achieving correct hydraulic-lifter preload check or valve-lash settings.



Each complete revolution on Comp's easy-to-read micrometer-like Hi-Tech pushrods equals a 0.050-inch change in length. Many factors influence pushrod length on modified engines, so pushrods are usually the last parts ordered after mocking up the entire valvetrain.

- **Using light springs** during a full engine hand-cycle for the purpose of determining pushrod length and proper valvetrain geometry may be smoother and easier on parts, including the adjustable checking pushrod.
- **Using the full** spring pack to find pushrod length better simulates high-rpm valvetrain deflection, assuming spring loads don't exceed the adjustable checking pushrod's strength.
- **Pushrods are usually** ordered last (and at the last minute), so many builders just use a fully assembled valvetrain including the regular spring pack, unless they observe (or know from experience) the adjustable checker pushrod can't handle the full valvespring load.

Source

Comp Cams; Memphis, TN; 800.999.0853; compcams.com

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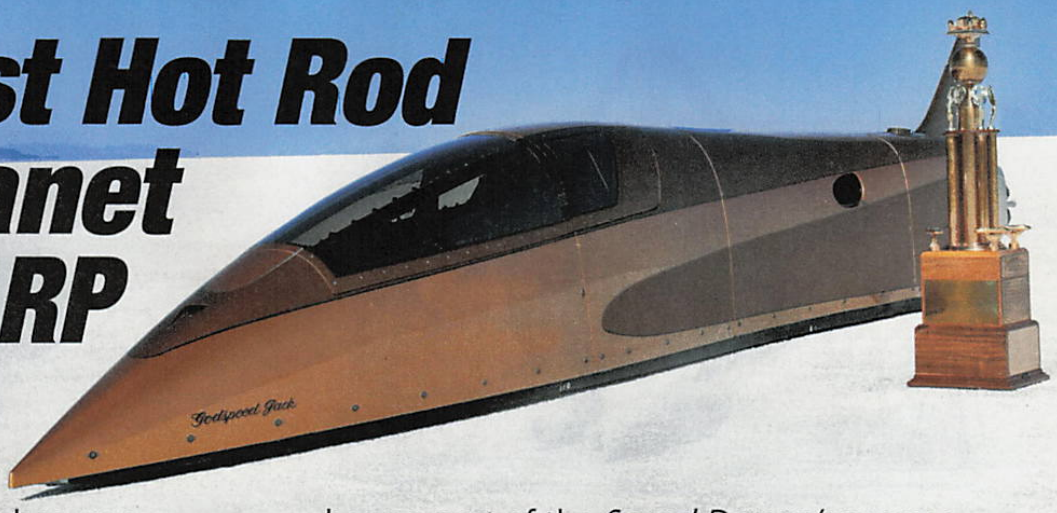

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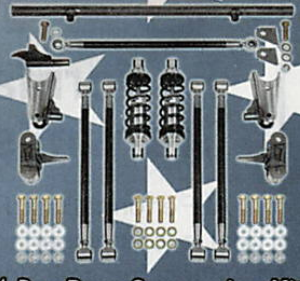

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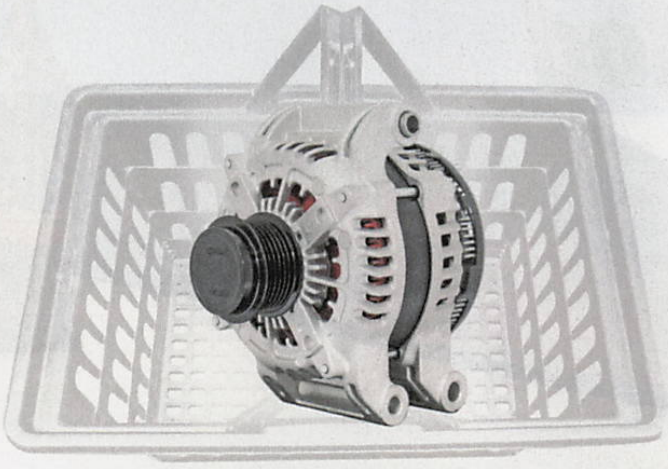

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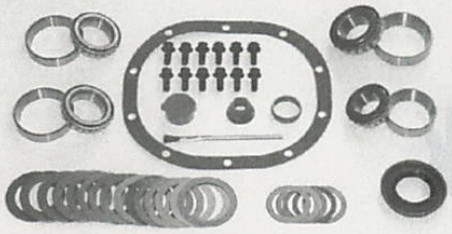

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The Shirt Off Your Back

By David Freiburger

Roadkill
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Ed Iskenderian is credited with inventing the branded T-shirt, handing them out to promote Isky cams in the '50s. I guess I should send him some thanks, or a royalty check, because I have a decent side hustle selling my own shirts and hoodies. That got me thinking about the T-shirts that impacted my life, because in the gearhead world, that's an actual thing.

The first shirt I coveted at an unreasonable level was a hand-me-down from my brother, a green shirt with the now-classic, then-current Suzuki S logo. I wasn't into dirt bikes, but my bro was, so therefore the shirt was cool. I wore it until it was loaded with holes and nearly transparent.

I never had a real Ed Roth monster shirt, but poured over the ads in the back of the mags. My mother thought they were too lowbrow and tasteless. I eventually had a Rat Fink shirt, and she somehow liked its awfulness.

Next came the drag racing shirts, my earliest entry into the apparel category of "hey look at me because I attended this rad event so I'm probably slightly better than you." Car people have honed that concept better than any sector outside of concert shirts. My first event shirt was from the NHRA SpringNationals, a race I never attended, but the shirt was in the bargain bin at the NHRA World Finals in Ontario, California, so that's what my dad bought for me.

Oh, concert shirts? My first was Billy Squire, which I also didn't attend. I had a friend get it for me at a Queen concert where Squire was the opening act. I threw it away as soon as that "Rock Me Tonight" video came out. But I wore my Ratt shirt into the ground. I also had the Ratt/Dale Pulde Funny Car shirt.

In the '80s there were still many speed equipment joints around Los Angeles. A Super Shops shirt made you kind of a newb, though Service Center garb moves you up a notch. Meanwhile, friends and I would strut with our Glendale Speed Center shirts like we were the old guard. The GSC shirt featured Fred Flintstone as a caricature of the shop owner, Rich Cholakian. Rich's brother Ed was known for a Cadillac collection and his T-shirt company. He and Andy "The Rodfather" Brizio of Andy's Tees printed most of the industry's shirts. I wore much of the Cholakian stuff, but particularly remember the "Supported By Milodon" shirt with the giant hand holding a blown early Hemi. (Incidentally, Milodon's name came from a blending of the names of founders Milo Franklin and Don "Dooner" Alderson; Dooner still had a shop in Glendale at the time.)

One curious shirt of the '80s was the Center Line Wheels design with a military tank with a set of Auto Drag wheels. One that was a little on the nose for today's OE marketers was the Mopar shirt that said "Bored With Ford? Get Direct Connection." Mine was two sizes too small, but I was skinnier then, so it was kinda metal. A particularly cool shirt was the Keith Black Racing Engines design, and wearing it was a way of saying that you really wished you had a KB jacket, and in SoCal it'd have to be embroidered with your name by the self-named Big Black Broke Bill Bailey who was at every track, every weekend, all year doing freehand embroidery for every racing hero you can name. He died in 2016, and his sewing machine is in the NHRA Museum.

There was a time when I collected T-shirts, and as a magazine guy, they multiplied like rabbits in the math club. I had several hundred, and finally gave up on hoarding them as treasures of the past. I took them to the swap meet and blew them out at 10 for a dollar or some such price scheme. I kept a few. I still have my Last Drag Race shirt from Orange County International Raceway, and another from Los Angeles County Raceway. I have a Bonneville Speed Week shirt signed by Andy Green, the fastest man on Earth. I kept shirts from the earliest days of the Fastest Street Car Shootout, Pump Gas Drags, and Drag Week.

These days I wear mostly my own designs plus Bonneville 200 MPH Club shirts, a couple designs from Top Fuel driver Clay Millican, one from Amarillo Dragway, a favorite from the NMCA, and some from Hot Rod Ranch. I have dozens of others, but this reminds me it's time to thin the herd again.

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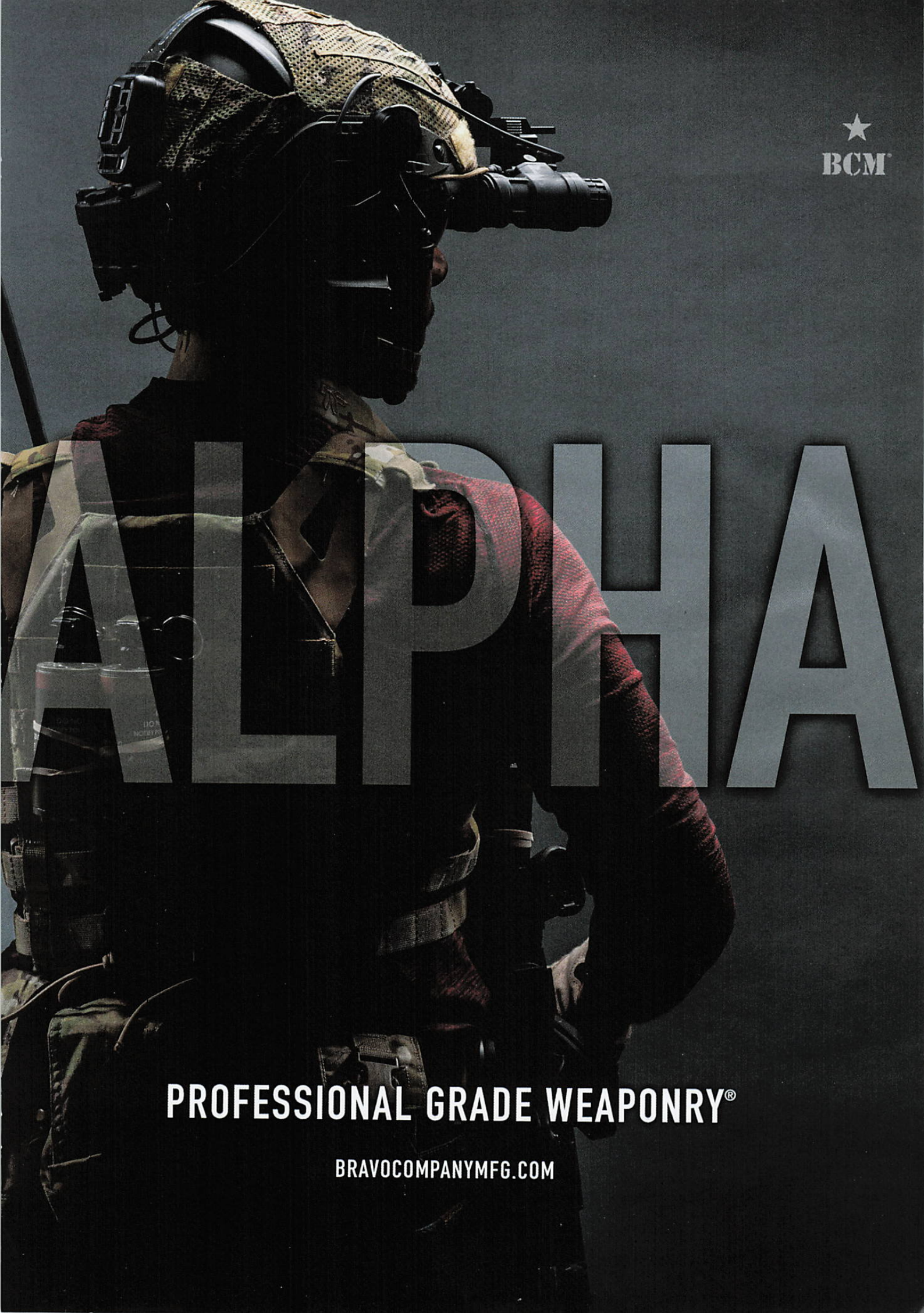
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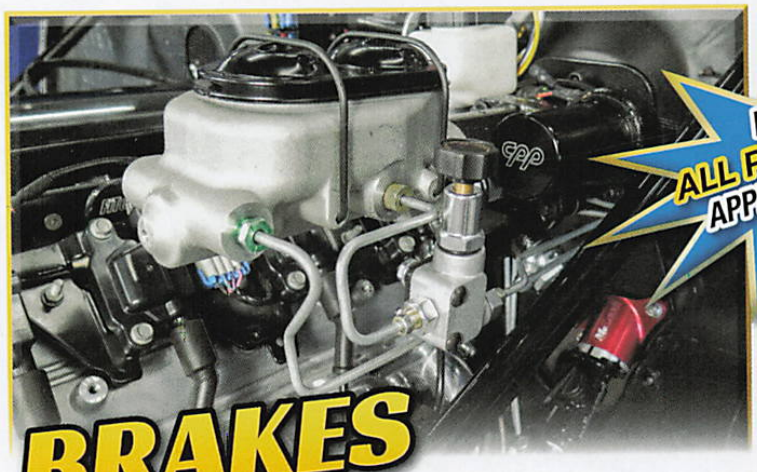

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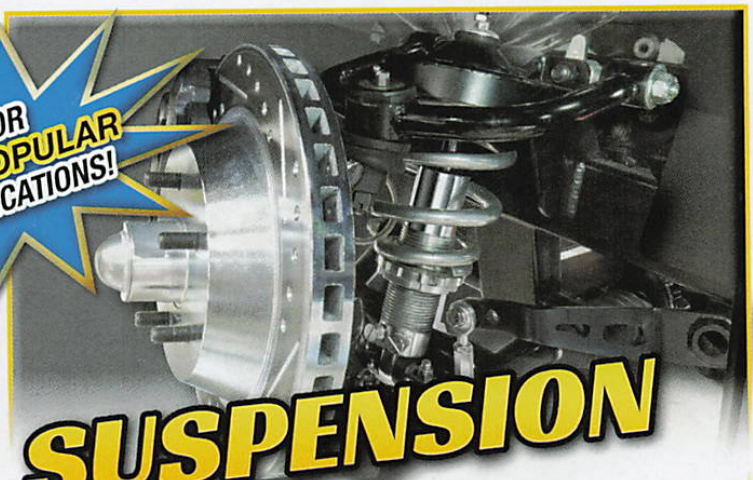

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